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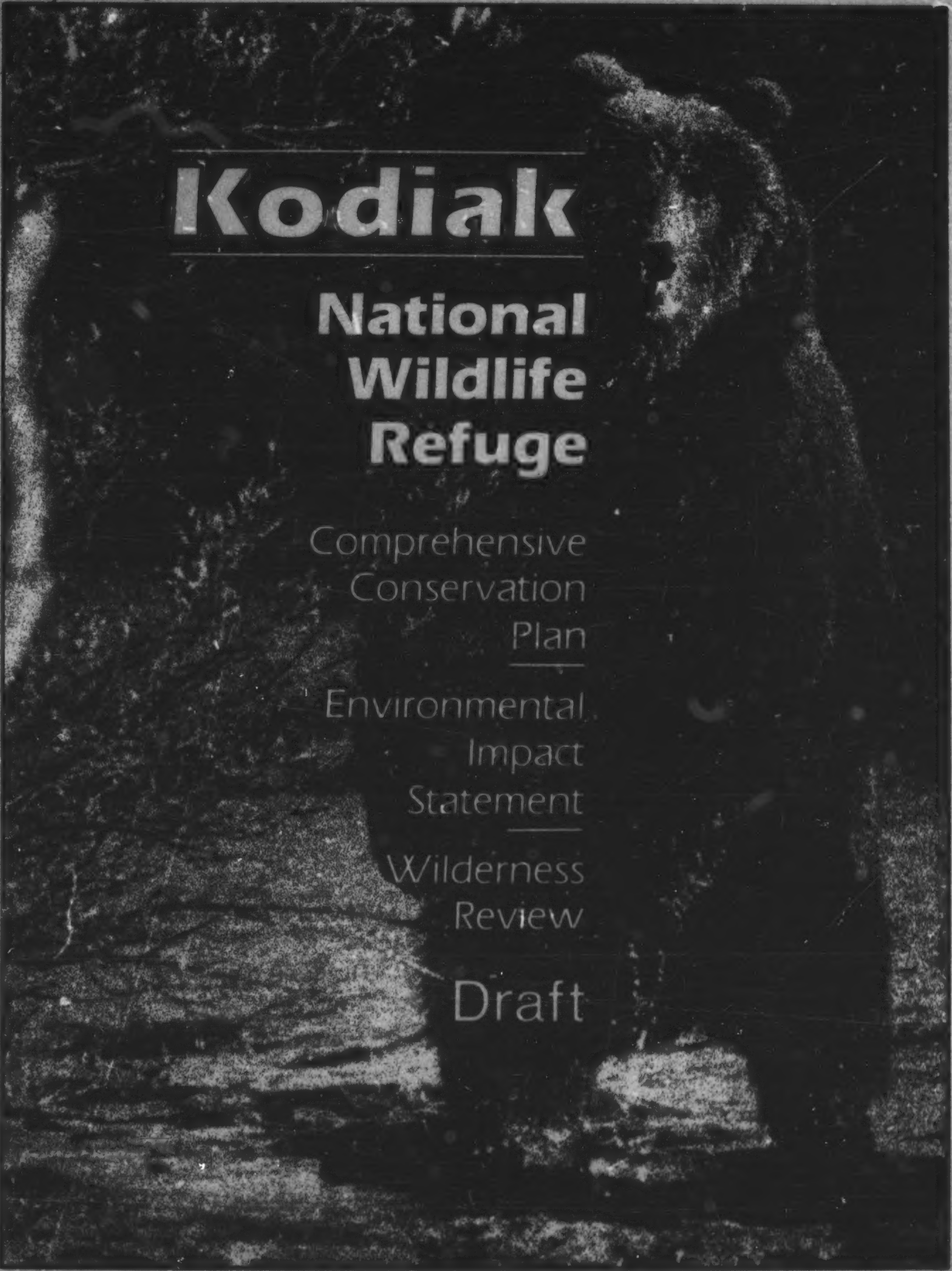

Kodiak

National Wildlife Refuge

Comprehensive Conservation Plan

Environmental Impact Statement

Wilderness Review

Draft

I 1.98:

March 3, 1849

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503

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Dear Reader:

Enclosed for your review and comment is a draft Comprehensive Conservation Plan/Environmental Impact Statement (CCP/EIS) and Wilderness Review for Kodiak National Wildlife Refuge, Alaska. This CCP/EIS has been prepared pursuant to Sections 304(g)(5) and 1317 of the Alaska National Interest Lands Conservation Act of 1980 (ANILCA), Section 3(d) of the Wilderness Act of 1964, and Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969. The draft CCP/EIS includes four alternative strategies for long-term management of the Kodiak National Wildlife Refuge.

When producing long term management plans for the nation's national wildlife refuges, the U.S. Fish and Wildlife Service actively seeks comments from the general public on the development of management alternatives and on the choice of a preferred management strategy. The management of national wildlife refuges in Alaska must conform to the legal and administrative requirements that are listed in the first section of this document. Ones that have a direct impact on the development of the long range plan and on the choice of the preferred management alternative are discussed below.

According to the National Wildlife Refuge System Administration Act and Section 304(b) of ANILCA, no use of a national wildlife refuge will be permitted unless it is first determined to be compatible with the purposes for which the refuge was established. Section 304(g) of ANILCA requires the preparation of a comprehensive conservation plan (CCP) such as this for each unit of the National Wildlife Refuge System (NWRS) established or enlarged by the Act. The CCP designates areas within the refuge according to their resources and values, outlines programs for conserving fish and wildlife resource values, and specifies uses within each area that may be compatible with the major purposes of the refuge. In addition, the plan discusses opportunities that will be made available for fish and wildlife oriented recreation, ecological research, environmental education and interpretation, and economic use of refuge lands. Comments received on the range of management alternatives and permitted activities presented in this plan will be taken into account during the development of a final plan.

In addition to presenting the Service's long range management strategies for Kodiak Refuge, the CCP evaluates the effect of the proposed management alternatives on subsistence uses and needs, as required by Section 810 of ANILCA. The law requires the Service to give adequate notice and hold public hearings before implementing any part of the plan determined to have an effect on subsistence. The public hearings held in conjunction with the development of this plan, the Section 810 evaluation found as part of the text, and the consideration of comments received on the plan are designed to meet these requirements.

Section 1008(a) of ANILCA directs the Secretary of Interior to establish an oil and gas leasing program on federal lands in Alaska except where prohibited by law or on those units of the NWRS where oil and gas development would be incompatible with refuge purposes. Through the planning process with its opportunity for public review, the Service is trying to determine to what extent oil and gas development should be permitted. The Secretary of Interior also must consult with the Secretary of Energy to determine the national interest in developing oil and gas on refuge lands. His finding could influence the establishment of an oil and gas program. In addition, the Secretary of Interior shall seek the views of the Governor of Alaska, local governments, Native corporations, the Alaska Land Use Council, representatives of the oil and gas industry, conservation groups, and other interested individuals.

None of the alternatives in the draft Kodiak Refuge CCP provide for this use because the refuge presently is not believed to have oil and gas potential and the use has been determined to be incompatible with refuge purposes in minimal management areas common to all alternatives. If upon further study the other portions of the refuge are determined to have oil and gas potential, and a determination is made that leasing would be in the national interest, the plan will be modified to show where compatible oil and gas development could occur.

Section 1317 of ANILCA requires the Service to review all non-wilderness lands in the National Wildlife Refuge System in Alaska to determine their suitability or non-suitability as wilderness and to subsequently recommend areas for inclusion in the National Wilderness Preservation System (NWPS). Section 4(a) of the Wilderness Act states that the designation of wilderness within a national wildlife refuge must be within and supplemental to the purposes for which the refuge was established.

Although large tracts of land on Alaska refuges may be found to be suitable as wilderness, not all land that is suitable will be proposed for wilderness designation because of the management strategies that will be used to meet refuge purposes. As a result, the range of wilderness alternatives is evaluated subsequent to the Service's selection of its preferred management alternative. Three wilderness proposals are examined in the draft Kodiak Refuge CCP/EIS, each under an appropriate management alternative, for adding parts of the refuge to the NWPS.

Congress established over 19 million acres of wilderness on Alaska refuges during the passage of ANILCA. Therefore, the criteria used to determine what land the Service additionally proposed for wilderness designation include (1) the need for wilderness unit boundary adjustment and (2) the addition of selected areas with outstanding resource values that may have been inadvertently overlooked during the original wilderness review and subsequent designations undertaken by Congress. A summary of public comments on the Service's recommended wilderness proposal will be included in the final CCP, which is part of the wilderness package sent to Congress.

The Service will conduct one public hearing, on February 5, 1985, at 7:00 p.m., at Clark Junior High School, 150 S. Bragaw St., Anchorage; a public meeting, at 7:00 p.m., January 22, 1986, in the Assembly Chambers of the Kodiak Island Borough Building, 700 Mill Bay Road, Kodiak; and public meetings in the communities of Karluk, Larsen Bay, Old Harbor, and Ahkiok during the end of January, 1986. The Service will send a letter to residents of the latter communities when it has finalized the dates.

Written comments are also welcome; they are accepted for a 90-day period, beginning with the date of the official announcement of availability in the Federal Register. In order to be considered in the preparation of the final CCP/EIS, your comments should be received no later than March 21, 1986. Comments or requests for further information should be directed to the Regional Director, Attention: Bill Knauer, (907) 786-3399.

Sincerely,

Regional Director

KODIAK NATIONAL WILDLIFE REFUGE
DRAFT COMPREHENSIVE CONSERVATION PLAN, WILDERNESS REVIEW AND ENVIRONMENTAL IMPACT STATEMENT

November, 1985

U.S. FISH AND WILDLIFE SERVICE
REGION 7, 1011 E. TUDOR RD.
ANCHORAGE, AK 99503

Kodiak National Wildlife Refuge is located on the western boundary of the Gulf of Alaska in southwestern Alaska. This draft comprehensive conservation plan and environmental impact statement describes four alternatives for managing Kodiak National Wildlife Refuge, and evaluates the effects of implementing each alternative. An alternative reflecting current management (no action), is included as one of the alternatives. The U.S. Fish and Wildlife Service's preferred alternative is identified and the criteria used in its selection are described. The plan also includes a wilderness review, which evaluates the suitability of lands for wilderness designation under each management alternative.

For further information contact William W. Knauer (907) 786-3399.

ANILCA REQUIREMENTS

Section 304(g) of ANILCA requires the preparation of a comprehensive conservation plan (CCP) for each unit of the National Wildlife Refuge System established or enlarged by ANILCA. These plans are to designate areas within the refuge according to their respective resources and values, specify the programs for conserving fish and wildlife resource values and specify the uses within each area which may be compatible with the major purposes of the refuge. The plan will also set forth those opportunities which will be provided within the refuge for fish and wildlife-oriented recreation, ecological research, environmental education and interpretation of refuge resources and values, and economic use.

FISH AND WILDLIFE PLANNING DOCUMENTS

The Fish and Wildlife Service planning process for each refuge involves a number of stages progressing from the development of a broad comprehensive conservation plan/environmental impact statement/wilderness review to the formulation of detailed management plans for implementing specific components of the CCP.

The CCP addressed topics of resource management, visitor use, refuge operations, and development in general terms. The wilderness review determines which lands are suitable for inclusion in the National Wilderness Preservation System. The goal of this plan is to establish a consensus between the Service and interested agencies, groups, and individuals about the types and levels of visitor use, development, and resource protection that will occur. These decisions are based on the purposes of the refuge, its significant values, the activities occurring there now, and the resolution of any major issues surrounding possible land use conflicts within and adjacent to the refuge. The following kinds of detailed management plans are prepared after completion of the CCP.

Refuge management plans identify the actions that will be taken to preserve and protect natural and cultural resources. Examples include a fishery management plan, a wildlife habitat management plan, a fire management plan, and a public use management plan. Public involvement and cooperative planning efforts are continued through the completion of the detailed management plans.

Annual work plans identify specific tasks or projects to be completed in the current year to implement the detailed management plans.

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ABBREVIATIONS

ADF&G - Alaska Department of Fish and Game

ANCSA - Alaska Native Claims Settlement Act (85 Stat. 688)

ANILCA - Alaska National Interest Lands Conservation Act (94 Stat. 2371)

BLM - Bureau of Land Management

°C - degrees Celsius

CCP - Comprehensive conservation plan

CFR - Code of Federal Regulations

cm - centimeter

cfs/mi^2 - cubic foot seconds/square mile

cms/km^2 - cubic meter seconds/square kilometer

DLP - bear kill in defense of life and property

DNR - Alaska Department of Natural Resources

EIS - Environmental Impact Statement

°F - degrees Fahrenheit

ha - hectare

kg - kilogram

km - kilometer

l/min - liters/minute

mg/l - milligrams/liter

NEPA - National Environmental Policy Act

NSSE - National Species of Special Emphasis

RNA - Research Natural Area

SUMMARY

SUMMARY

INTRODUCTION

This document describes four alternatives for managing Kodiak National Wildlife Refuge, and identifies the possible consequences of implementing the alternatives. Each alternative provides broad policy guidance for managing the refuge. Each alternative also identifies lands suitable for wilderness designation, as well as those lands, if any, proposed for designation.

Kodiak Refuge encompasses about 1,865,000 acres (755,000 ha) on Kodiak, Uganik, Afognak and Ban islands in southwestern Alaska.[a] The islands, part of the Kodiak Archipelago, lie at the western border of the Gulf of Alaska. The city of Kodiak is about 250 air miles (402 km) from Anchorage and about 21 miles (34 km) northeast of the refuge boundary.

Kodiak Refuge is larger than the state of Delaware, but no place on Kodiak Island is more than 15 miles (24 km) from the sea. The refuge contains a variety of landscapes, including glacial valleys, tundra uplands, lakes, wetlands, sand and gravel beaches, salt flats, meadows, and rugged mountains. The refuge's eleven large lakes and many rivers are major spawning grounds for five species of salmon. Steelhead, rainbow trout and Dolly Varden are also found in the refuge waters. Besides brown bear there are only five other native land mammals in Kodiak Refuge: red fox, river otter, short-tailed weasel, little brown bat, and tundra vole. Several other species, including Sitka blacktail deer, elk, and beaver, have been introduced into the refuge. Whales, porpoises, sea otters, and sea lions are found in the bays adjacent to the refuge. Over 200 species of birds have been seen on the Kodiak Archipelago. At least 200 pairs of bald eagles nest on the refuge. An estimated 2 million seabirds winter in the refuge's bays, inlets and shores. Many waterfowl, numbering at least 200,000 birds, also winter along the shoreline and on the refuge proper.

President Franklin D. Roosevelt established Kodiak National Wildlife Refuge by Executive Order 8857 on August 14, 1941, to preserve the natural feeding and breeding ground of the brown bear and other wildlife. The refuge boundary was adjusted in 1958 to resolve a perceived bear/livestock problem. In 1971 Congress enacted the Alaska Native Claims Settlement Act (ANCSA). As part of the settlement, about 310,000 acres (125,000 ha) of Kodiak Refuge lands were conveyed to Native village corporations and Native groups. Congress redesignated Kodiak Refuge in 1980 when it enacted the Alaska National Interest Lands Conservation Act (ANILCA). The Act also added 50,000 acres (20,000 ha) on Afognak and Ban islands to the refuge. ANILCA declared the purposes for which Kodiak Refuge was established and shall be managed include:

> (i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, Kodiak brown bears, salmonoids, sea otters, sea lions, and other marine mammals and migratory birds;

---

[a] The 1,865,000-acre figure includes Native conveyed lands within the refuge boundary.

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;

(iii) to provide, in a manner consistent with purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents; and

(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in subparagraph (i), water quality and necessary water quantity within the refuge.

PLANNING PROCESS

The first step in developing a comprehensive conservation plan for Kodiak Refuge was to collect information. Field inventories, remote sensing, and literature searches produced information about refuge resources and uses. Public meetings, workshops, and other means were used to learn what people were concerned about, and what they felt should be done on the refuge.

All available information was then analyzed with the help of resource specialists from several agencies and the private sector to identify special values, problems and issues as required by ANILCA.

The following were identified as special values of the refuge: Kodiak brown bear; the diversity of resources and uses of the refuge; Kodiak Refugium and associated glacial lakes; Ayakulik/Red, Karluk, Sturgeon, and Dog Salmon drainages; Uganik Lake; Three Saints Bay; Mount Glottof Research Natural Area; and the refuge's coastal estuaries.

Ten potential problems affecting fish and wildlife were identified for Kodiak Refuge: development and use of existing commercial and public use facilities within the refuge; development and use of private inholdings and adjacent lands; impacts due to increasing public use; loss of wilderness values; subsistence, commercial and sport harvests of fish; fishery management activities; conflicts between users; grazing of domestic livestock; oil and gas staging; and lack of resource data.

Issues raised by the public included: protection of fish and wildlife; management of brown bear; need for additional studies; management of the Mount Glottof Research Natural Area; inadequate law enforcement; access opportunities in the refuge; protection of the subsistence way of life; management of public use cabins; need for visitor education; management of commercial guides and their facilities; use of set net cabins in the refuge; development of hydroelectric facilities; grazing of livestock, oil and gas development, and other economic development in the area; development and use of private inholdings in the refuge; and the need for cooperation with local residents.

This document includes a wilderness review and recommendations. The Service identified 19 potential issues relating to wilderness designation on Kodiak Refuge, of which one was determined to be significant: what will be the impact of designating wilderness on the refuge's fish and wildlife habitats and population?

Public Comments on the Draft CCP/EIS

Following review of the draft CCP/EIS by government agencies, Native corporations, special interest groups, and the general public, the Service will revise the document, including the alternatives as necessary, and will publish a final CCP/EIS. A detailed account of the comments and how they were used in revising this document will be included in the final document. After a 30-day protest period following publication of the final CCP/EIS expires, the Service will issue a record of decision and will begin implementing the selected alternative.

Implementation and Revision of the Comprehensive Conservation Plan

Implementation of the proposed actions in this plan will depend upon the availability of funds and personnel, and upon the coordination of many governmental activities. These factors will determine the extent of development, management and maintenance the refuge receives in any given year.

Following adoption of the plan, the Service will, as necessary, undertake detailed "management planning" to guide implementation of the plan and operation of the refuge. In accordance with Service policy, detailed management plans will be prepared to address specific resource and public use management activities such as fisheries, wilderness, fire, habitat, and recreation management.

The Kodiak Refuge Comprehensive Conservation Plan/Environmental Impact Statement provides broad policy guidance for managing Kodiak Refuge over the next 10 to 15 years. It should be viewed as a dynamic document that will need to be reviewed and updated periodically. Every three to five years the Service will review public comments, local and state government recommendations, staff recommendations, and research studies, among other sources, to determine if revisions to the plan are necessary. If major changes are proposed, public meetings may be held, or new environmental assessments/environmental impact statements may be necessary. Full review and updating of the plan will occur every 10 to 15 years, more often if necessary.

MANAGEMENT OF NATIVE CONVEYED LANDS

The Service has developed a process for determining those uses and other activities that would be appropriate on Native lands within the refuge boundary that are subject to Section 22(g) of ANCSA. Management of the Native lands will be an ongoing, cooperative process, involving both the Service and the village corporations. The intent of the 22(g) review process is to protect important fish and wildlife resource values while enabling the Native landowners to derive economic benefits from their land. The Service will apply Section 22(g) using a three tier process. The refuge comprehensive conservation plan sets the general basis for determining compatibility. The plan identifies where the important areas are for fish and wildlife, and establishes the Service's management intent for the Native lands. Once the comprehensive conservation plan is approved, the Service will promulgate specific 22(g) regulations for Kodiak Refuge that implement the performance objectives. These regulations "shall permit such uses that will not materially impair the values for which the refuge was established," as required under Department of Interior regulations (43 CFR 2650.4-6(b)). The Service's permit system then will be used to both determine if a specific use or development would be in compliance with refuge rules and regulations, and identify what stipulations or mitigation measures that may be necessary to meet the performance objectives.

COMMON MANAGEMENT DIRECTIONS

Management of Kodiak Refuge under any alternative is governed by federal laws, Service policies, and principles of sound resource management--all of which restrict the range of potential activities. Accordingly, certain management directions must be implemented in all of the management alternatives for Kodiak Refuge. These common management directions include:

- managing the Mount Glottof Research Natural Area as a minimal management area or as a wilderness area, if designated by Congress, to protect the natural resource and research values of this area;
- coordinating management with other resource management agencies, and cooperating with owners of refuge inholdings and adjacent lands;
- working with the state to ensure that all Service actions taken under this plan are consistent with the state approved coastal zone management plan;
- collecting data on fish and wildlife species, public use, and other topics that are of high management concern;
- ensuring that fish and wildlife populations and ecological relationships necessary to conserve natural diversity are maintained;
- permitting existing fish management structures (e.g., the Frazer Falls fish pass, and egg-take and incubation facilities on the upper Thumb River) to continue operations;
- working with ADF&G to maintain the refuge's fish and wildlife populations (see Appendices F, K, L and M for cooperative agreements);
- ensuring the Service is in compliance with state water quality standards for refuge waters;
- ensuring that subsistence opportunities are maintained by assessing potential impacts of proposed uses or activities, conducting research, enforcing regulations, and monitoring fish and wildlife populations and uses;
- maintaining opportunities for recreational hunting, fishing, trapping, and other wildlife-oriented activities on the refuge;

- providing reasonable access onto the refuge so visitors can participate in wildlife-oriented recreational activities;
- permitting the use of motorboats, airplanes, and non-motorized surface transportation methods for traditional activities on refuge lands, and for travel to and from villages and homesites, subject to reasonable regulations;
- requiring special use permits for all commercial air taxi operators and marine boat transporters taking people into the refuge;
- permitting guides and outfitters to use the refuge, subject to stipulations to reduce the potential for resource impacts; tents would be permitted, but no new permanent structures;
- limiting, if necessary, on a seasonal or area-specific basis how long groups in tents can stay at at one location;
- permitting oil and gas exploration, including seismic exploration, throughout the refuge on a case by case basis, subject to a determination of compatibility with refuge purposes and consistency with management objectives;
- prohibiting oil and gas development on all minimal management areas common to all alternatives; on all other areas oil and gas development will not be permitted until the oil and gas potential has been assessed, a compatibility determination completed, and a national interest determination made; and
- providing for commercial set net fishermen to continue to operate on the refuge, subject to reasonable regulations.

ALTERNATIVES AND ENVIRONMENTAL CONSEQUENCES

The following section briefly describe the alternatives and the environmental consequences that could result from their implementation. The alternatives are general in nature and provide broad strategies for management of refuge resources and users. Each of the alternatives designates areas within the refuge using management categories described in Chapter VI. To evaluate the effects of each alternative the Service developed four scenarios that describe events likely to occur on the refuge. These scenarios, and the definitions of the magnitudes of the impacts, are described in Chapter VII.

ALTERNATIVE A (THE CURRENT SITUATION)

Alternative A, the "no action" alternative, would maintain the status quo on Kodiak Refuge. In this alternative the Service would maintain the refuge's fish and wildlife values and natural diversity. Opportunities for hunting, fishing and other recreational uses and subsistence uses would be maintained. Additional guides and outfitters would be permitted to use the refuge. New temporary commercial support facilities may be permitted in the moderate management areas on the coast. In this alternative (and in all of the other alternatives) the Service would apply guidelines for resource protection on

Native lands based on its assessment of the relative importance of the resource values present. No areas would be proposed for wilderness designation.

Management Directions

Alternative A would:

- maintain the refuge in an undeveloped state;
- emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats;
- provide for continued subsistence use of refuge resources;
- maintain traditional access opportunities;
- maintain opportunities for recreational hunting and fishing in the refuge;
- permit guides and outfitters to operate in the refuge, with limited support facilities in designated areas;
- permit commercial fishermen to continue using support facilities on the refuge's coastline, with opportunities for limited expansion of temporary facilities (i.e., tent platforms); and
- propose no areas for wilderness designation.

Environmental Consequences

Fish and Wildlife
- Negligible effects on sockeye, chum and pink salmon, waterfowl, shorebirds, raptors, marine birds.
- Negligible effects overall on brown bear, with minor to moderate impacts in localized areas.
- Minor impacts to the refuge's chinook fishery, and marine mammals.
- Possible moderate impacts to coho salmon and rainbow trout, and major impacts to steelhead.

Water Quality and Quantity
- Increased erosion in localized areas, but no significant changes in water quality or quantity.

Population and Economy
- Seasonal increase in the population of the city of Kodiak.
- Minor benefits to the city of Kodiak's economy, primarily to recreation-related businesses.

Subsistence
- No significant effect on important resources or the harvest of these resources.

Recreation
- Increased competition and perceived overcrowding in popular fishing and hunting areas.
- Negligible effect on nonconsumptive users and no effect on bear hunters.

Cultural Resources
- Moderate impacts from increased public use, with severe localized impacts possible.

Wilderness Values

- Wilderness values would be maintained in most of the refuge.

Wilderness Designation

- No areas would be designated; the Service would retain maximum flexibility for managing the refuge.

ALTERNATIVE B

Under Alternative B the Service would continue to protect fish and wildlife populations and habitats, while providing opportunities for additional public use and limited commercial uses. Opportunities for hunting, fishing and other recreational uses would be increased by providing new public use cabins or developed campsites, increasing the number of permits for guides and outfitters that wish to operate on the refuge, and providing additional opportunities for guides and outfitters to use temporary facilities on designated areas in the refuge's interior and coast. Seventy-one percent of the refuge would be designated as minimal management areas and proposed for wilderness designation.

Management Directions

Alternative B shares the following management directions with Alternative A (the Current Situation). Alternative B would:

- maintain the refuge in a relatively undeveloped state;
- emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats;
- maintain opportunities for sport hunting and fishing;
- maintain traditional access opportunities; and
- provide for continued subsistence use of refuge resources.

The following management directions indicate the major differences in Alternative B from Alternative A. Alternative B would:

- provide significantly more opportunities for guided and outfitted use on the refuge;
- provide additional opportunities for guides and outfitters to use temporary support facilities in designated parts of the refuge;
- provide additional opportunities for limited commercial development in designated areas in the refuge interior and coast;
- provide additional cabins or campsites for the public to use; and
- propose most of the Kodiak Refuge interior for wilderness designation.

Environmental Consequences

Fish and Wildlife

- Negligible effects on sockeye, chum and pink salmon, shorebirds, and marine birds.
- Minor effects on the refuge's coho fishery, and marine mammals.
- Minor effects overall on waterfowl and raptors, with moderate effects possible in localized areas.

- Moderate effects on brown bear due to increased public use.
- Possible major impacts to chinook, rainbow trout and steelhead.

Water Quality and Quantity
- Increased erosion in localized areas, but no significant changes in water quality or quantity.

Population and Economy
- Greatest seasonal increase in the population of the city of Kodiak of the four alternatives.
- Minor benefits to the city of Kodiak's economy, primarily to recreation-related businesses.

Subsistence
- No significant effect on important resources or the harvest of these resources.

Recreation
- Increased numbers of sport hunters and fishermen would use the refuge compared to Alternative A.
- Substantial increases in competition and perceived overcrowding for all user groups.

Cultural Resources
- Moderate impacts from increased public use, with severe localized impacts possible.

Wilderness Values
- Wilderness values generally would be maintained in the refuge, but values would be diminished in localized areas due to increased public use.

Wilderness Designation
- Wilderness designation would provide long-term protection to fish and wildlife resources and wilderness values.
- A significant area would be added to the National Wilderness Preservation System.
- Some commercial uses, management practices, and new permanent facilities would be precluded; this could limit management flexibility.
- Recreational and subsistence uses and existing commercial uses would not be affected by wilderness designation, although public use could eventually increase because of the designation.

Alternative C (The Preferred Alternative)

Alternative C describes the way in which the Service proposes to manage Kodiak Refuge. Alternative C emphasizes protection of fish and wildlife populations and habitats, while providing for some limited increases in public use. Special attention would be devoted to protecting the resource values in the Sturgeon, Karluk, Ayakulik/Red and Dog Salmon drainages. Opportunities for hunting, fishing and other recreational uses would be maintained. Additional opportunities would be provided for commercial guides and outfitters to use temporary support facilities and for other commercial uses along the coast.

Seventy-three percent of the refuge lands would be designated as minimal management areas and proposed for wilderness.

Alternative C shares the following management directions in common with Alternative A (the Current Situation). Alternative C would:

- maintain the refuge in an undeveloped state;
- emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats;
- maintain opportunities for sport hunting and fishing;
- maintain traditional access opportunities;
- provide for continued subsistence use of refuge resources; and
- permit commercial fishermen, guides and outfitters to use support facilities on the refuge's coastline, with opportunities for limited expansion of temporary facilities (i.e., tent platforms).

The following management directions indicate the major differences in Alternative C from Alternative A. Alternative C would:

- provide additional opportunities for guided and outfitted use in the refuge;
- provide increased protection of fish and wildlife resources on coastal areas;
- manage use on the Ayakulik/Red, Sturgeon, Karluk and Dog Salmon drainages to protect sensitive fish and wildlife resources and provide a primitive recreational experience; and
- propose most of the areas suitable for wilderness in the refuge interior for wilderness designation.

Environmental Consequences

Fish and Wildlife

- Negligible effects on sockeye, chum and pink salmon, waterfowl, shorebirds, raptors, and marine birds.
- Negligible to minor effects overall on brown bear.
- Minor impacts to the refuge's coho fishery, and marine mammals.
- Minor to moderate impacts to the refuge's chinook, rainbow trout and steelhead fishery.

Water Quality and Quantity

- Increased erosion in localized areas, but no significant changes in water quality or quantity.

Population and Economy

- Seasonal increase in the population of the city of Kodiak
- Minor benefits to the city of Kodiak's economy, primarily to recreation-related businesses.

Subsistence

- No significant effect on important resources or the harvest of these resources.

Recreation

- o Reduced competition and perceived overcrowding in popular fishing and hunting areas relative to Alternative A.
- o Negligible effect on nonconsumptive users and bear hunters.

Cultural Resources

- o Moderate impacts from increased public use, with severe localized impacts possible.

Wilderness Values

- o Wilderness values generally would be maintained in the refuge, but values would be diminished in localized areas due to increased public use.

Wilderness Designation

- o Wilderness designation would provide long-term protection to fish and wildlife resources and wilderness values.
- o A significant area would be added to the National Wilderness Preservation System.
- o Some commercial uses, management practices, and new permanent facilities would be precluded; this could limit management flexibility.
- o Recreational and subsistence uses and existing commercial uses would not be affected by wilderness designation, although public use could eventually increase because of the designation.

ALTERNATIVE D

Of all the alternatives considered, Alternative D would provide the maximum protection to fish and wildlife values. The Service would restore important habitat on the coastline by removing existing commercial support structures whenever legally possible, such as when operations cease or are abandoned. Special attention would be devoted to protecting the resource values in the Sturgeon, Karluk, Ayakulik/Red and Dog Salmon drainages. Opportunities for hunting, fishing and other recreational uses would continue to be provided in the refuge, although the growth in both guided/outfitted and unguided use, and access may be limited in parts of the refuge to minimize potential resource impacts. Commercial uses would be limited to existing valid commercial fishing support facilities and guiding and outfitting. Existing permanent and temporary commercial support structures would continue to be allowed, but the Service would work with the users to remove structures where there are resource concerns. New commercial operators would be based out of tents that would be removed after the season of use--no new permanent or temporary support facilities would be permitted in the refuge. In this alternative all of the refuge lands would be proposed for wilderness designation.

Alternative D has the following similarities with Alternative A (the Current Situation). Alternative D would:

- o maintain the refuge in an undeveloped state;
- o emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats;
- o maintain traditional access opportunities;

- provide for continued subsistence use of refuge resources;
- permit guides and outfitters to operate in the refuge, with limited support facilities in designated areas; and
- permit commercial fishermen to continue using support facilities on the refuge's coastline, with opportunities for limited expansion of temporary facilities (i.e., tent platforms).

The following management directions indicate the major differences in Alternative D from Alternative A. Alternative D would:

- restore fish and wildlife habitat along coastal areas by removing commercial support facilities wherever possible;
- manage use on the Ayakulik/Red, Sturgeon, Karluk and Dog Salmon drainages to protect sensitive fish and wildlife resources and to provide a primitive recreational experience;
- reduce the number of public use cabins in the refuge;
- reduce the number of permitted sport fish guides and outfitters;
- require guides and outfitters to use tents;
- regulate the number of unguided users in the refuge if necessary; and
- propose all of the refuge lands for wilderness designation.

Environmental Consequences

Fish and Wildlife

- Negligible effects on sockeye, chum and pink salmon, waterfowl, shorebirds, raptors, and marine birds.
- Negligible effect on brown bear, with minor impacts in localized areas.
- Minor impacts to the refuge's coho fishery, and marine mammals.
- Minor to moderate impacts to the refuge's chinook, rainbow trout and steelhead fishery.

Water Quality and Quantity

- Increased erosion in localized areas, but no significant changes in water quality or quantity.

Population and Economy

- Smallest seasonal increase in the population of the city of Kodiak of the four alternatives.
- Minor benefits to the city of Kodiak's economy, primarily to recreation-related businesses.

Subsistence

- No significant effect on important resources or the harvest of these resources.

Recreation

- Reduced competition and perceived overcrowding in popular fishing and hunting areas relative to Alternative A.
- Negligible effect on nonconsumptive users and bear hunters.

Cultural Resources

- Moderate impacts from increased public use, with severe localized impacts possible.

Wilderness Values

- Wilderness values generally would be maintained in the refuge, but values would be diminished in localized areas due to increased public use.

Wilderness Designation

- Wilderness designation would provide long-term protection to fish and wildlife resources and wilderness values.
- A significant area would be added to the National Wilderness Preservation System.
- Some commercial uses, management practices, and new permanent facilities would be precluded; this could limit management flexibility.
- Recreational and subsistence uses and existing commercial uses would not be affected by wilderness designation, although public use could eventually increase because of the designation.

SECTION 810(a) EVALUATION

The Service has determined in its Section 810(a) evaluation that neither the management recommendations nor the preferred alternative would significantly restrict subsistence uses in Kodiak Refuge, although concerns over increased recreational use may be expressed. The harvest of marine resources, the most important resources used by local residents for subsistence purposes, occurs outside of the refuge and would not be affected by actions described in Alternative C. Increased numbers of sport hunters and fishermen in this alternative would take more deer and salmon in the refuge than in 1984, but sufficient deer and salmon should be available for local residents to satisfy their needs. The Service would work with the Native villages and corporations, ADF&G and the state Boards of Fisheries and Game to ensure that subsistence activities are not adversely affected by actions taken in this alternative.

SELECTION OF THE PREFERRED ALTERNATIVE

The Service has selected Alternative C as its preferred alternative for managing Kodiak Refuge on the basis that it would both satisfy the purposes of the refuge, and ensure that the opportunities for high quality recreational experiences are maintained for the widest range of users. The alternative would continue most existing refuge policies, which are well accepted by most users, and would provide opportunities for additional use. With increased public use, some adverse impacts would be expected to refuge resources and users, but these would tend to be concentrated in a few areas. Under this alternative the Service would lay the groundwork for future regulation of refuge users, if that becomes necessary, in the special river management areas (i.e., the Karluk, Dog Salmon, Sturgeon, and Ayakulik/Red rivers). The Service would also carefully monitor and regulate all uses and activities both within and adjacent to the refuge to ensure that adverse impacts to refuge resources and users are minimized.

It must be stressed that the selection of Alternative C as a preferred alternative is tentative. The Service will not finalize its recommendation until affected local, state and federal government agencies, industry, local interests, conservation groups, and other interested parties and individuals have had a chance to review and comment on the proposed plan. Depending on the comments received, there could be changes in the alternatives, including the Service's choice of a preferred alternative.

The west arm of the Terror Lake valley.

I. INTRODUCTION

I. INTRODUCTION

PURPOSE AND NEED FOR ACTION

The purpose of this planning action is to develop a comprehensive conservation plan (CCP) for Kodiak National Wildlife Refuge, Alaska. The CCP is a congressionally mandated plan that serves as a "master" plan, providing broad policy guidance and establishing the long-term goals and objectives for Fish and Wildlife Service management of the refuge. It also is a means of informing interested parties how the lands and resources in the refuge will be managed over the next 10 to 15 years. The CCP should be viewed as a dynamic document that will need to be reviewed and updated periodically. Supplemental management plans will be prepared in the future to specifically address the management of rivers, fish and wildlife, and other topics.

This document includes a draft environmental impact statement (EIS) for the Kodiak Refuge Comprehensive Conservation Plan. It describes four alternative plans for managing Kodiak Refuge (including the alternative proposed as the Kodiak Refuge CCP). The document includes a description of the existing environment on the refuge and an assessment of the effects of implementing each of the four alternatives. Each alternative provides differing choices for addressing internal management concerns and for resolving public issues. After public review, the Service will evaluate comments on this draft EIS, make revisions as necessary, and publish a final EIS.

Federal statute requires preparation of a plan to guide management of Kodiak National Wildlife Refuge. Section 304(g) of the Alaska National Interest Lands Conservation Act of 1980 (ANILCA; PL 96-487) directs the Secretary of the Interior to prepare, and from time to time, revise, a "... comprehensive conservation plan ... for each refuge (in Alaska)...."

This document also serves as the wilderness review for Kodiak Refuge. Section 1317 of ANILCA directs the Secretary to study all lands in the refuge and make recommendations as to areas considered suitable for inclusion in the National Wilderness Preservation System. The document identifies lands that would be suitable for wilderness designation. Each alternative includes a wilderness recommendation based on this evaluation and the management directions of the alternative.

In addition to the above requirements, a comprehensive conservation plan is needed to:

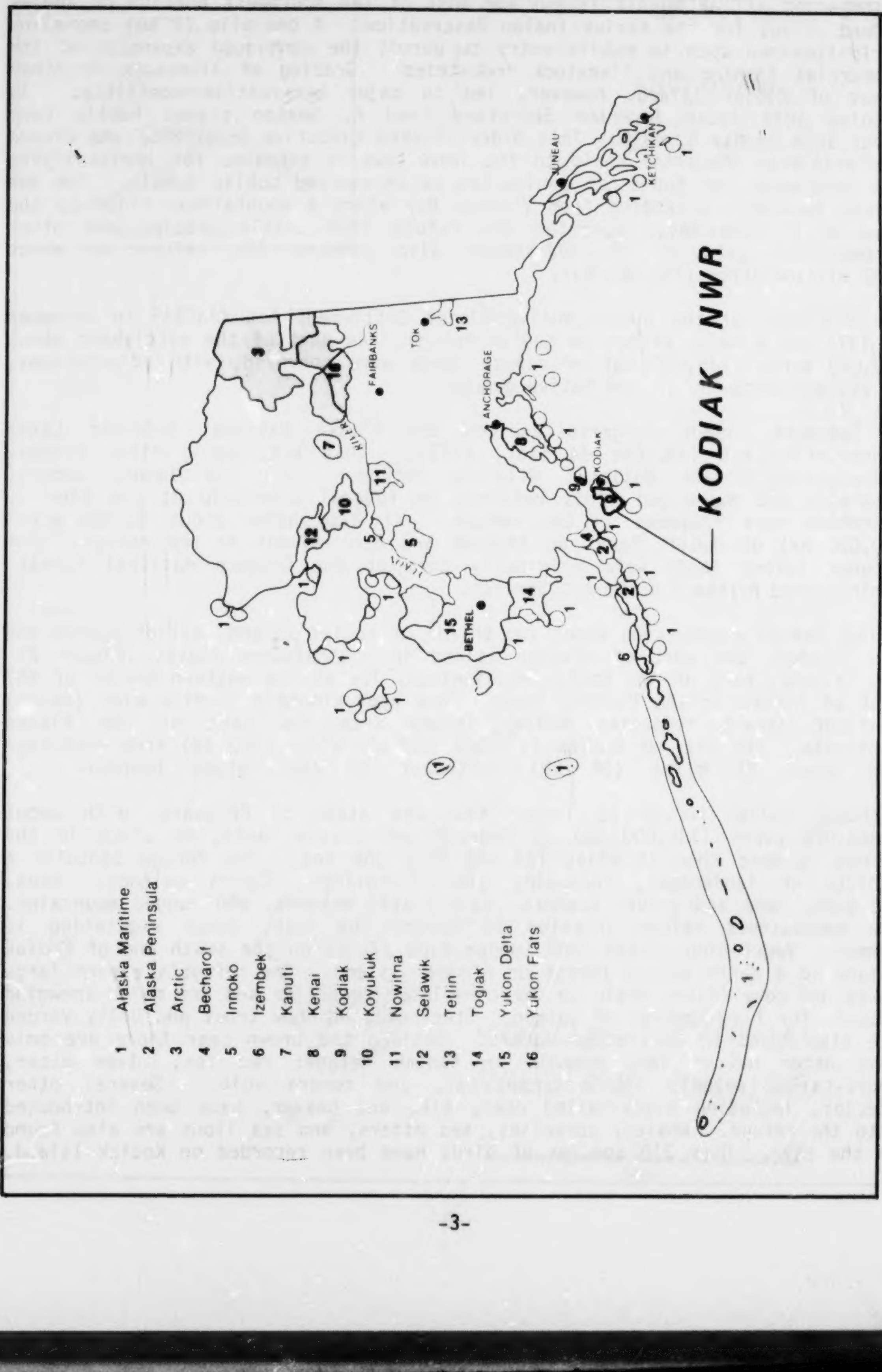
- ensure that national policy direction is incorporated in the management of the refuge;
- provide a systematic process for making and documenting refuge decisions;
- establish broad management strategies for refuge management programs and activities;
- provide continuity in the management of the refuge;
- provide a basis for budget requests; and
- provide a basis for evaluating accomplishments.

OVERVIEW OF THE REFUGE

In the late 1800's and early 1900's major changes began to affect Kodiak Island's resources. During this period human activity and developments increased on the island: canneries were built to process fish and shellfish resources, and cattle and sheep were introduced. As a result of bear/livestock conflicts, in the late 1930's government hunters were called in to reduce livestock losses. Also about this time conservation groups became concerned for the welfare of the brown bear and advocated establishment of a refuge on Kodiak Island. On August 14, 1941, President Franklin D. Roosevelt established Kodiak National Wildlife Refuge by Executive Order 8857 to preserve the natural feeding and breeding range of the brown bear and other wildlife. The refuge thus became a part of the National Wildlife Refuge System, managed by the U.S. Fish and Wildlife Service. The refuge system includes over 420 units in 49 states, with 16 refuges in Alaska (Figure 1).

Visitors from around the world come to observe, hunt, and photograph Kodiak's brown bears.

Figure 1. National wildlife refuges in Alaska.


KODIAK NWR
1 Alaska Maritime
2 Alaska Peninsula
3 Arctic
4 Becharof
5 Innoko
6 Izembek
7 Kanuti
8 Kenai
9 Kodiak
10 Koyukuk
11 Nowitna
12 Selawik
13 Tetlin
14 Togiak
15 Yukon Delta
16 Yukon Flats
JUNEAU
KETCHIKAN
ANCHORAGE
KODIAK
FAIRBANKS
TOK
BETHEL
RIVER

The original Executive Order withdrew about 1.957 million acres (792,000 ha) from unreserved public domain on Kodiak and Uganik Islands. The refuge encompassed all of Uganik Island and most of the southwest portion of Kodiak Island except for the Karluk Indian Reservation. A one-mile (2 km) shoreline strip remained open to public entry to permit the continued expansion of the commercial fishing and livestock industries. Grazing of livestock in other areas of Kodiak Island, however, led to major bear/cattle conflicts. To resolve this issue Interior Secretary Fred A. Seaton signed Public Land Order 1634 on May 9, 1958. This Order revoked Executive Order 8857 and closed the mile-wide shoreline strip to the land laws in exchange for reclassifying the Shearwater and Kupreanof peninsulas as unreserved public domain. The new refuge boundary, extending from Viekoda Bay along a mountainous ridge to the head of Kiliuda Bay, separated the refuge from cattle grazing and other incompatible uses. The adjustment also reduced the refuge to about 1.82 million acres (736,000 ha).

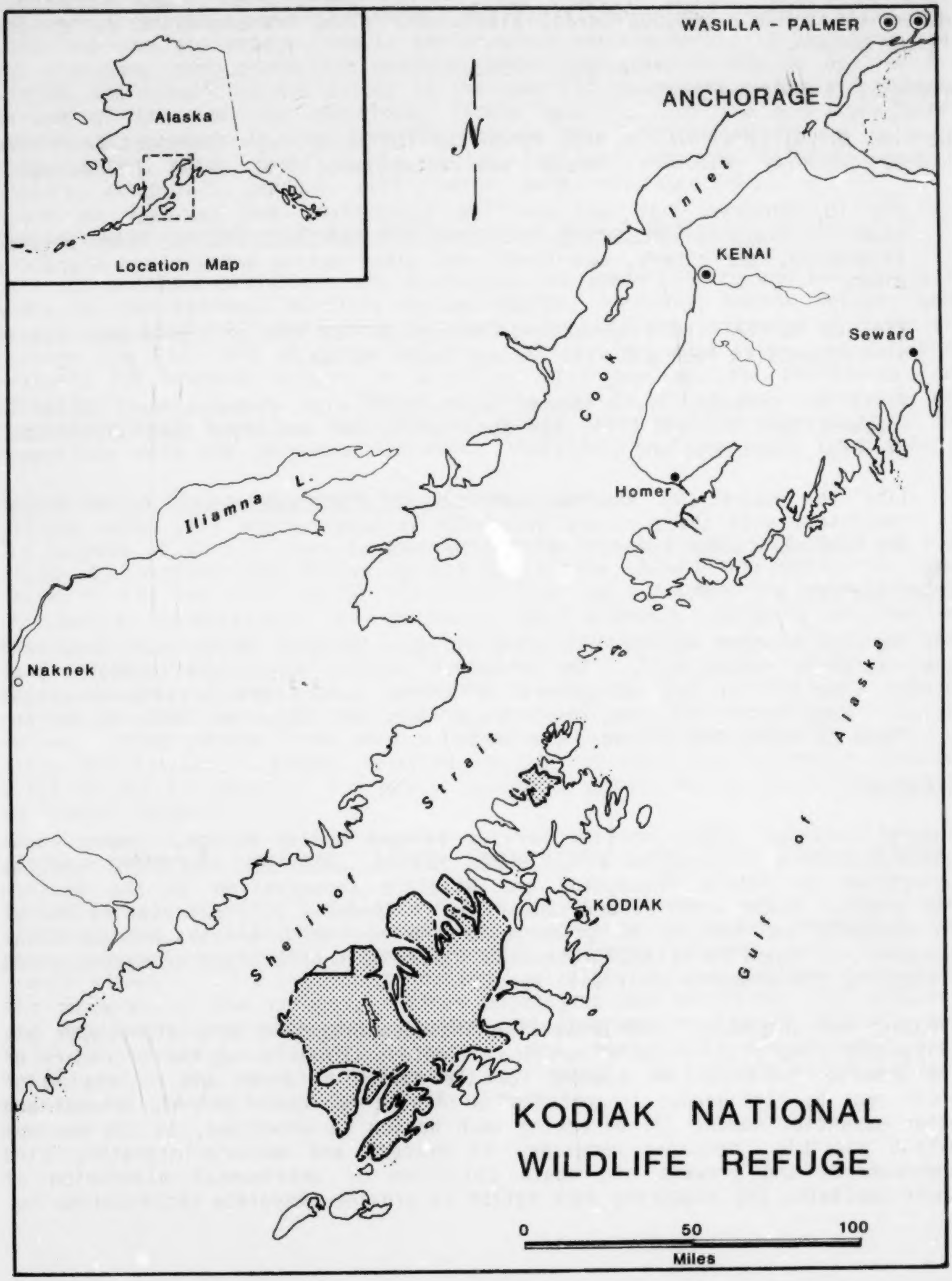
The enactment of the Alaska Native claims Settlement Act (ANCSA) in December of 1971 had a major effect on Kodiak Refuge. As part of the settlement about 310,000 acres (125,000 ha) of refuge lands were conveyed, with stipulations, to village corporations and Native groups.

In December, 1980, Congress enacted the Alaska National Interest Lands Conservation Act (ANILCA; 94 Stat. 2371). This Act, among other things, redesignated Kodiak National Wildlife Refuge. All the lands, waters, interests and submerged lands retained in federal ownership at the time of statehood were included in the refuge. It also added about 50,000 acres (20,000 ha) of public lands on Afognak and Ban islands to the refuge. The Afognak Island lands were originally part of the Chugach National Forest, administered by the U.S. Forest Service.

Kodiak Refuge encompasses about two-thirds of Kodiak Island, all of Uganik and Ban islands, and part of Afognak Island in southwestern Alaska (Figure 2). The islands, part of the Kodiak Archipelago, lie at the western border of the Gulf of Alaska in the Pacific Ocean. The approximately 30-mile wide (48-km) Shelikof Strait separates Kodiak Island from the base of the Alaska Peninsula. The city of Kodiak is about 250 air miles (402 km) from Anchorage and about 21 miles (34 km) northeast of the refuge boundary.

Although Kodiak Refuge is larger than the state of Delaware, with about 1,865,000 acres (755,000 ha) of federal and Native lands, no place in the refuge is more than 15 miles (24 km) from the sea. The refuge contains a variety of landscapes, including glacial valleys, tundra uplands, lakes, wetlands, sand and gravel beaches, salt flats, meadows, and rugged mountains. The mountainous refuge interior is covered by lush, dense vegetation in summer. Vegetation varies from tundra type plants on the south end of Kodiak Island to a dense spruce forest on Afognak Island. The refuge's eleven large lakes and many rivers drain to the convoluted coastline and are major spawning grounds for five species of salmon. Steelhead, rainbow trout and Dolly Varden are also found in the refuge waters. Besides the brown bear there are only five other native land mammals in Kodiak Refuge: red fox, river otter, short-tailed weasel, little brown bat, and tundra vole. Several other species, including black-tailed deer, elk, and beaver, have been introduced into the refuge. Whales, porpoises, sea otters, and sea lions are also found in the bays. Over 210 species of birds have been recorded on Kodiak Island.

Figure 2. Location of Kodiak Refuge.


Alaska
Location Map
N
WASILLA - PALMER
ANCHORAGE
Cook Inlet
KENAI
Seward
Homer
Iliamna L.
Naknek
Shelikof Strait
KODIAK
Gulf of Alaska
KODIAK NATIONAL WILDLIFE REFUGE
0
50
100
Miles

At least 200 pairs of bald eagles nest on the refuge. An estimated 2 million seabirds winter in the refuge's bays, inlets and shores. Many waterfowl, numbering at least 200,000 birds, also winter along the shoreline and on the refuge proper.

PURPOSES OF KODIAK REFUGE

Section 303(5)(B) of ANILCA sets forth the following major purposes for which Kodiak National Wildlife Refuge was established and shall be managed:

> (i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, Kodiak brown bears, salmonoids, sea otters, sea lions, and other marine mammals and migratory birds;
>
> (ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;
>
> (iii) to provide, in a manner consistent with purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents; and
>
> (iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in subparagraph (i), water quality and necessary water quantity within the refuge.

LEGAL CONTEXT

The Service manages national wildlife refuges pursuant to various legal and administrative requirements. The principal treaties and federal statutes that affect planning for and management of Kodiak Refuge are briefly discussed below. Regulations that implement these laws are found in Title 50 of the U.S. Code of Federal Regulations (50 CFR).

Treaties

Several treaties affect how the Service manages Kodiak Refuge. Among these are migratory bird treaties with Canada, Mexico, Japan and the USSR, and the Convention on Nature Protection and Wildlife Conservation in the Western Hemisphere. These treaties are summarized in Appendix I. The treaties differ in emphasis and species of primary concern but collectively provide clear mandates for identifying and protecting important habitats and ecosystems, and protecting and managing individual species.

Treaties for migratory bird protection include management provisions such as: (1) prohibiting disturbance of nesting colonies; (2) allowing the Secretary of the Interior to establish seasons for the taking of birds and collection of their eggs by "indigenous inhabitants" of Alaska for their own nutritional and other essential needs; (3) directing each Nation to undertake, to the maximum extent possible, measures necessary to protect and enhance migratory bird environments and prevent and abate pollution or detrimental alteration of their habitats; (4) requiring each Nation to provide immediate notification to the other when pollution or destruction of habitats occurs or is expected; (5) stipulating that each Nation shall, to the extent possible, establish preserves, refuges, protected areas, and facilities for migratory birds and their habitats and manage them to preserve and restore natural ecosystems; and (6) providing that protective measures under the treaties may be applied to species and subspecies not listed in the specific convention, but which belong to one of the families containing listed species. Of the migratory bird species of concern in the treaties, those that use Kodiak Refuge include loons, swans, geese, ducks, hawks, eagles, harriers, ospreys, falcons, cranes, plovers, sandpipers, jaegers, gulls, terns, owls, and passerines.

National Wildlife Refuge System Administration Act of 1966

This act provides guidelines and directives for administering and managing all areas in the National Wildlife Refuge system, including Kodiak Refuge, and further provides that the system be administered by the Secretary of Interior through the Fish and Wildlife Service. It defines key terms, establishes criteria for opening refuges to migratory bird hunting, and procedures for divestiture of lands. The law also establishes the standard of "compatibility," requiring that uses of refuge lands must be determined to be compatible with the purposes for which individual refuges were established.

Alaska Native Claims Settlement Act of 1971 (ANCSA)

The purpose of this act was to provide for "a fair and just settlement of all claims by Natives and Native groups of Alaska, based on aboriginal land claims." The law provided for grants of land and money and the establishment of Native corporations to maintain the economic affairs of Native organizations. Under Section 12(a) village corporations were able to select lands, with several stipulations, in national wildlife refuges. Under Section 22(g), however, refuge lands conveyed to the village corporations remain subject to the laws and regulations governing use and development of the refuge. Other refuge lands were selected based on Section 14(h)(1) (cemetery sites and historical places selected by the regional corporation). Section 17(b) of the Act provided for public easements across Native lands for access to federal lands.

Alaska National Interest Lands Conservation Act of 1980 (ANILCA)

In addition to amending the Alaska Native Claims Settlement Act and the Alaska Statehood Act, ANILCA expanded the federal conservation system throughout the state (including refuges, parks, forests, wilderness areas, and wild and scenic rivers). With respect to national wildlife refuges, ANILCA sets forth the purposes of the refuges, defines objectives and provisions for planning and management, and authorizes studies and programs related to wildlife and wildland resources, commodity resources, and recreational and economic uses (such as oil and gas exploration and development, subsistence opportunities, access, and transportation and utility systems).

National Environmental Policy Act of 1969 (NEPA)

This act requires that federal agencies carefully analyze impacts prior to taking major federal actions that may significantly affect the quality of the human environment. Implementation of any one of the alternatives for managing Kodiak Refuge is such an action. Therefore, this planning process is subject to NEPA requirements.

Wilderness Act of 1964

This act established the National Wilderness Preservation System, provides the framework for designation by Congress of new units to the system, and prescribes policy for management of these areas. Section 1317 of ANILCA requires the "review, as to their suitability or nonsuitability for preservation as wilderness, all lands within . . . units of the National Wildlife Refuge System in Alaska not designated as wilderness by this Act..." No wilderness was designated in Kodiak Refuge by ANILCA.

Endangered Species Act of 1973, as amended

This act provides for the conservation of threatened and endangered species of fish, wildlife, and plants by federal action and by encouraging the establishment of state programs. Among its provisions the Act authorizes the determination and listing of endangered and threatened species and the habitat critical to those species; prohibits unauthorized taking, possession, sale, transport, etc., of endangered species; provides authority to acquire land for the conservation of listed species with land and water conservation funds; and authorizes the assessment of civil and criminal penalties for violating the Act or implementing regulations. Section 7 of the Endangered Species Act requires federal agencies to insure that any action authorized, funded, or carried out by them does not jeopardize the continued existence of listed species or modify their critical habitat.

Antiquities Act, Archeological Resources Protection Act, and National Historic Preservation Act of 1966, as amended

These laws make reference to cultural resources or govern the management of cultural resources on federal lands. The various historic preservation laws, in general, do the following:

(1) Vest ownership of historic and prehistoric properties and of materials collected from such sites with the state and federal government.

(2) Protect archeological and historic sites from unauthorized disturbance and prescribe penalties for individuals who damage (or collect from) such sites. Provide for issuing of permits to qualified individuals and institutions to conduct scientific research.

(3) Mandate the inventory and evaluation of all sites on government owned and managed lands. Inventory is the responsibility of the individual federal agency involved.

(4) Require that all projects with state or federal involvement be conducted in such a way as to protect any significant cultural resources that may be present. This includes, but is not limited to, the performance of archeological surveys, site evaluations, and, if necessary, mitigation of adverse impacts on such resources.

THE KODIAK REFUGE PLANNING PROCESS

Legal and Administrative Planning Requirements

Section 304(g) of ANILCA sets forth standards to be achieved in the development of comprehensive conservation plans for national wildlife refuges in Alaska. Specifically, prior to developing a plan for any refuge, the Secretary of the Interior is required to identify and describe:

> (A) the populations and habitats of the fish and wildlife resources of the refuge;
>
> (B) the special values of the refuge, as well as any other archeological, cultural, ecological, geological, historical, paleontological, scenic, or wilderness value of the refuge;
>
> (C) areas within the refuge that are suitable for use as administrative sites or visitor facilities, or for visitor services, as provided for in sections 1305 and 1306 of this Act;
>
> (D) present and potential requirements for access with respect to the refuge, as provided for in Title XI; and
>
> (E) significant problems which may adversely affect the populations and habitats of fish and wildlife identified and described under subparagraph (A).

Additionally, each plan shall:

> (A)... based upon the identifications and the descriptions required ... [as noted above]-
>
> > (i) designate areas within the refuge according to their respective resources and values;
> >
> > (ii) specify the programs for conserving fish and wildlife and the programs relating to maintaining the values referred to in paragraph (2)(B), proposed to be implemented with such areas; and
> >
> > (iii) specify the uses within each such area which may be compatible with the major purposes of the refuge; and
>
> (B) set forth those opportunities which will be provided within the refuge for fish and wildlife-oriented recreation, ecological research, environmental education and interpretation of refuge resources and values, if such recreation, research, education, and interpretation is compatible with the purposes of the refuge.

In preparing the plans the Secretary is required to ensure adequate interagency coordination and public participation. Specifically, interested and affected parties such as state agencies, Native corporations, and residents of local villages and political subdivisions must be provided opportunities to present their views. Further, prior to adopting a plan the Secretary is required to issue notice of its availability in the Federal Register, make copies available in regional offices of the Fish and Wildlife Service throughout the U.S., and provide opportunity for public views and comments.

Finally, Section 1317 of ANILCA requires the Secretary to conduct a wilderness review, consistent with provisions of the Wilderness Act, of all refuge lands in Alaska not already designated as wilderness. Based on this review and public comment, the Secretary is to forward recommendations to the President and Congress regarding any lands considered suitable for addition to the National Wilderness Preservation System.

The Planning Process

The planning process used to develop the comprehensive conservation plan for Kodiak Refuge was designed to fulfill the legal mandates cited above as well as the administrative requirements pertaining to all units of the National Wildlife Refuge System. Each plan alternative was developed to represent a long-range strategy and a broad framework for management and use of refuge resources. The foundation upon which the alternatives were developed and evaluated was provided by the purposes of the refuge set forth in ANILCA, by other laws and regulations governing administration and management of the refuge system, and by the missions of the Fish and Wildlife Service and the National Wildlife Refuge System. The mission of the Service is to "provide the federal leadership to conserve, protect and enhance fish and wildlife and their habitats for the continuing benefit of people." The mission of the refuge system is "to provide, preserve, restore, and manage a national network of lands and waters sufficient in size, diversity and location to meet society's needs for areas where the widest possible spectrum of benefits associated with wildlife and wildlands is enhanced and made available." Figure 3 shows the major steps of the process used in developing this plan.

PUBLIC COMMENTS ON THE DRAFT CCP/EIS/WILDERNESS REVIEW

Following review of the draft CCP/EIS/Wilderness Review by government agencies, Native corporations, special interest groups, and the general public, the Service will revise the document, including the alternatives as necessary, and will publish a final CCP/EIS/Wilderness Review. A detailed account of the comments and how they were used in revising the draft will be included in the final document. After a 30-day protest period following publication of the final CCP/EIS expires, the Service will issue a record of decision and will begin implementing the selected alternative.

Figure 3. The refuge comprehensive conservation planning process.

Step 1 - PREPLANNING

- Identify laws, regulations, policies and direction
- Develop analysis methods and capabilities
- Prepare public involvement plan
- Hold region-wide public scoping meetings
- Identify management issues and concerns
- Prepare physical, biological, economic and social environment description

Step 2 - INVENTORY

- Assemble data base or inventory, of resources
- Identify habitat and population models
- Identify resource management units

Step 3 - FORMULATE MANAGEMENT ALTERNATIVES

- Develop alternative strategies for management
- Identify different combinations of uses for resources
- Determine management directions for each alternative

Step 4 - ANALYZE MANAGEMENT ALTERNATIVES

- Identify sensitivity of fish and wildlife resources to land uses
- Describe changes in the impacts of each alternative
- Identify changes from base line in the physical, biological, social, and economic environment

Step 5 - EVALUATION OF ALTERNATIVES

- Evaluate biological and socioeconomic effects of each alternative, and the extent to which issues and concerns raised by the public are met

Step 6 - PLAN SELECTION

- Recommend a proposed alternative

Step 7 - PUBLISH DRAFT CCP/EIS

- Prepare and distribute a draft plan that describes the alternatives and their expected consequences when implemented

Step 8 - PUBLIC COMMENT

- Provide opportunities for public comments and analyze the feedback

Step 9 - PUBLISH FINAL CCP/EIS

- Prepare and distribute a final plan that is responsive to comments received on the draft document
- Provide 30-day period for public comments and protest

Step 10 - ISSUE RECORD OF DECISION

- Implement the Comprehensive Conservation Plan

IMPLEMENTATION AND REVISION OF THE COMPREHENSIVE CONSERVATION PLAN

Implementation of the proposed actions in this plan will depend upon the availability of funds and personnel, and upon the coordination of many governmental activities. These factors will determine the extent of development, management and maintenance the refuge receives in any given year.

Following adoption of the plan, the Service will, as necessary, undertake detailed "management planning" to guide implementation of the plan and operation of the refuge. In accordance with Service policy, detailed management plans will be prepared to address specific resource and public use management activities such as wilderness, habitat, and recreation management.

In implementing the CCP the Service periodically will need to prepare site-specific evaluations to determine whether various proposed activities or uses are compatible with refuge purposes. All formal compatibility determinations will be reviewed by the regional office to ensure that the findings are consistent with the Service's regional policies. A record of the compatibility determinations will be kept on file and will be used as precedents for future decisions on refuge uses.

After implementation of the comprehensive conservation plan begins, it will be necessary to periodically review and revise portions of the plan. As knowledge of the refuge's resources and users improves, changes in management directions may be identified. The refuge's fish and wildlife populations, user groups, adjacent land uses and other management considerations change with time--often in unforeseen ways. Problems also may be encountered in trying to implement the plan.

Most of the resulting changes will "fine-tune" the plan. These changes will not require modification of this document--minor changes will be addressed in the more detailed refuge management plan and annual work plan advices. Only if a significant change is required in the management of the refuge will it become necessary to change the CCP. For example, a revision of the plan would become necessary if a change is required in management that would cause major biological or socioeconomic impacts, or that would result in significant controversy (as evidenced by public comments).

To enable refuge users, adjacent landowners, local, state and federal agencies, and other interested parties to express their views on how the refuge is being managed, the Service will periodically hold meetings, or use other techniques such as comment cards and surveys, to solicit comments for evaluation purposes. By encouraging continuing public input in the management of the refuge the Service will be better able to serve the public, to determine potential problems before they occur, and to take immediate action to resolve existing problems.

Every three to five years the Service will review public comments, local and state government recommendations, staff recommendations, and research studies, among other sources, to determine if revisions to the plan are necessary. If major changes are proposed, public meetings may be held, or new environmental assessments or environmental impact statements may be necessary. Full review and updating of the plan will occur every 10 to 15 years, more often if necessary.

II. SPECIAL VALUES OF KODIAK REFUGE

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In response to requirements of Section 304(g) of ANILCA, the Service identified eleven special values for Kodiak Refuge. Figure 4 shows where the geographical areas are in the refuge.

Kodiak Refuge was originally designated to conserve the Kodiak brown bear--the largest brown bear in the world. The refuge's bears are its most well-known feature, attracting visitors from around the world. The refuge supports the highest known density of brown bear in the world (Troyer and Hensel, 1964; Cowan, 1972). The three largest brown bears ever harvested and 33 of the 50 largest bears in the Boone & Crockett list are from Kodiak Island. The majority of these bears were taken on Kodiak Refuge. Novels and short stories have been written and motion pictures made about Kodiak bears and the other fish and wildlife in the refuge.

The diversity of resources and uses of the refuge, including landforms, habitats, fish and wildlife, and subsistence and recreational uses is noteworthy in Alaska. The refuge supports brown bears, bald eagles, and salmon, species of special interest to many Americans:

o In addition to brown bear, the refuge provides excellent opportunities for hunting black-tailed deer, and limited opportunities for mountain goat, elk, small game, waterfowl, and upland game bird hunting.

o About 200 pairs of bald eagle nest on Kodiak Refuge, one of the largest concentrations of bald eagle nests in the country.

o Numerous streams in the refuge provide habitat for anadromous fish. The pink, sockeye, chum, chinook and silver salmon, Dolly Varden/arctic char and rainbow/steelhead trout populations found in the refuge are of special value to sport fishermen, commercial fishermen, and subsistence fishermen. It is estimated between 1981 and 1984 that an annual average of 12.3 million dollars (ex-vessel value[a]) worth of salmon were harvested from refuge based stocks.

The Kodiak Refugium and associated glacial lakes in the southwestern portion of the refuge have special scientific, educational and recreational values. The area's distinctive flora and rolling landscape contrasts with the rugged terrain elsewhere on the island. During the Pleistocene Era, about 10,000 years ago, ice sheets completely covered the Kodiak Archipelago except for the highest peaks and apparently the refugium (see Figure 6). The refugium area contains the highest diversity and greatest densities of wildlife on the island, including the highest concentrations of brown bears in North America, areas where brown bear congregate in high numbers during the salmon run, the highest density of nesting waterfowl species (including tundra swans) on the island, and the highest summer feeding concentration of bald eagles. The vegetative characteristics of the area are representative of the arctic, the Bering Sea coast and southern Alaska Peninsula coast. Several large glacially formed lakes, Karluk, Frazer, Red and Akalura lakes, in or near the refugium, provide spawning habitat for salmon and key habitats for bears, eagles, and other wildlife.

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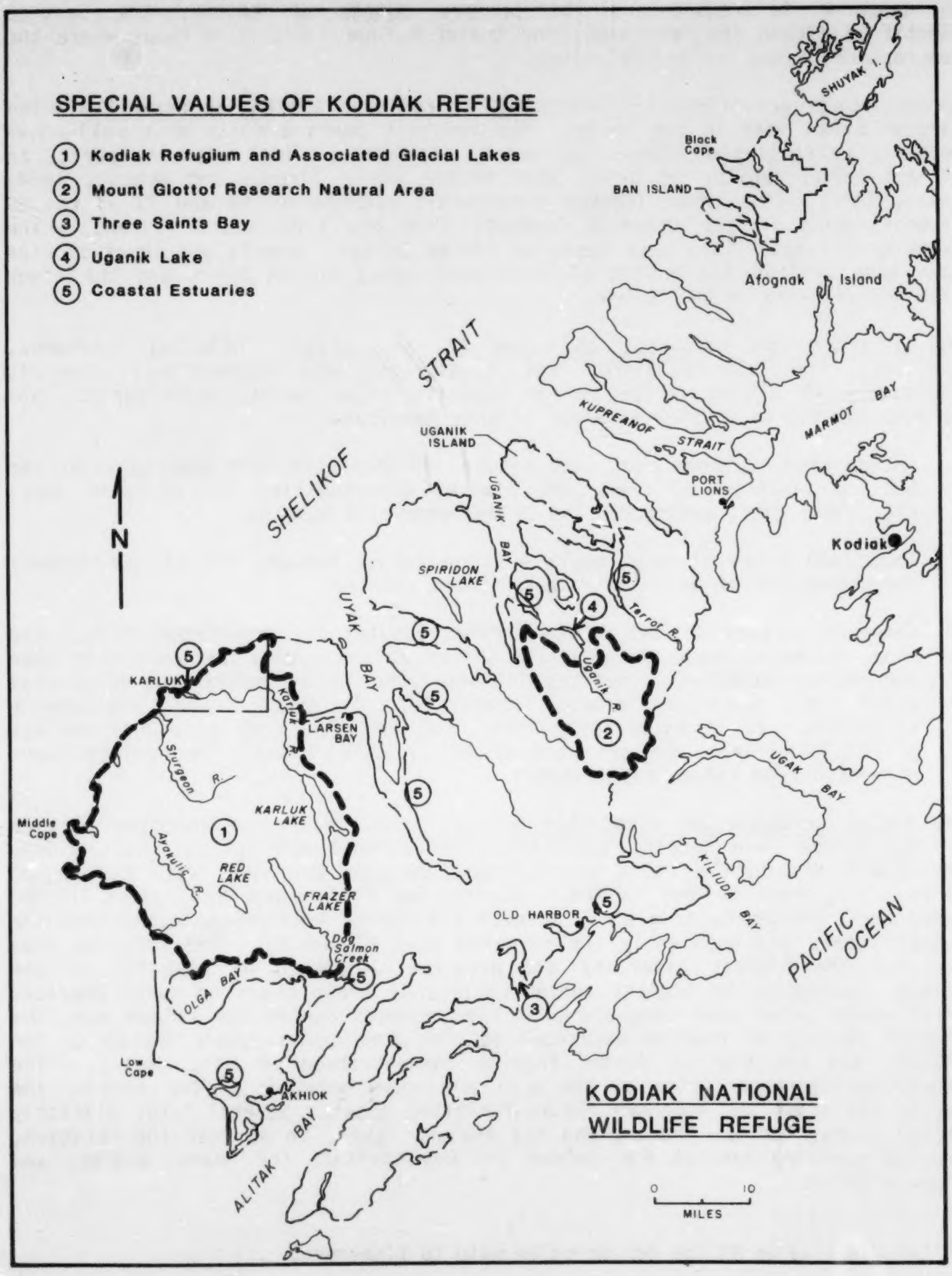
[a] Ex vessel value is the dollar value paid to fishermen.

Figure 4. Special values of Kodiak Refuge.


SPECIAL VALUES OF KODIAK REFUGE
① Kodiak Refugium and Associated Glacial Lakes
② Mount Glottof Research Natural Area
③ Three Saints Bay
④ Uganik Lake
⑤ Coastal Estuaries
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
N
UGANIK BAY
SPIRIDON LAKE
Terror R.
UYAK BAY
Uganik R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
UGAK BAY
Middle Cape
KARLUK LAKE
Ayakulik R.
RED LAKE
FRAZER LAKE
KILIUDA BAY
OLD HARBOR
Dog Salmon Creek
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0 10
MILES

Three notable drainages are in the Kodiak Refugium: the Karluk, Ayakulik/Red, and Sturgeon rivers. All of these drainages support large runs of Pacific salmon, support high concentrations of wildlife (particularly brown bear and eagles), and have high recreation and economic values:

- The Ayakulik/Red River drains an area of about 166 square miles (430 km^2). The Ayakulik River is about 40 miles (60 km) in length; the Red River drains Red Lake and flows 4 miles (6 km) before joining the mainstem Ayakulik. These rivers provide spawning or rearing habitat for all five Pacific salmon, rainbow/steelhead trout and Dolly Varden. Average annual escapement (1979 to 1984) of all five species of Pacific salmon have reached or exceeded 1.14 million fish during the even years and 338,000 fish in the odd years. The Ayakulik/Red River is one of the two drainage systems in the refuge (and one of the few such drainages in an Alaska national wildlife refuge) where both steelhead and chinook salmon populations occur in abundance. The fish provide a food source for high concentrations of both bald eagles and brown bears. About 40 to 200 bald eagles use the drainage in July and August and 50 to 80 are estimated to use the lower mainstem river sections from October to late November.

The Ayakulik/Red River provides many recreational opportunities from June through November.

An estimated 30 to 50 brown bear use the drainage annually. Annual aerial stream index surveys for brown bear on selected tributaries of the drainage indicate that counts of 15 to 30 animals within Pinnell Creek (a tributary to Red Lake) is common from late July to August. This drainage also provides high recreational value opportunities for the visiting public from June through November.

- The mainstem Karluk River is 21 miles (34 km) long and drains an area of about 240 square miles (620 km^2). This river also provides spawning or rearing habitat for all five species of Pacific salmon, rainbow/steelhead trout, and Dolly Varden/arctic char. The Karluk River is the only other drainage system in the refuge (and one of the few such drainages in an Alaska national wildlife refuge) where both steelhead and chinook salmon populations occur in abundance. Average annual escapement (1979 to 1984) of all five species of Pacific salmon have reached or exceeded 2.5 million fish during the even years and 406,000 fish during the odd year returns. The fish species provide a food source for high concentrations of both bald eagles and brown bears. From about 20 to 150 bald eagles use the Karluk River and its tributaries as feeding areas. Although relatively little brown bear activity is documented on the lower Karluk River

Karluk Lake scenery.

corridor, the upper river and those lateral and terminal tributaries to Karluk Lake provide a food source for an estimated 20 to 30 brown bears from June through September. The Karluk River, like the Ayakulik/Red River, provides the visiting public with almost constant opportunities for recreation from June through November.

- The Sturgeon River is 16 miles (26 km) long and drains an area of about 65 square miles (170 km^2). The river is used by pink, chum and coho salmon for spawning or rearing. The early run of chum salmon into the river (with an estimated average annual escapement from 1979 to 1984 in excess of 91,000 fish) is one of the earliest and most important on the refuge. The fish in this river, like the other rivers, provide a food source for high concentrations of both bald eagles and brown bear. An estimated 100 to 250 bald eagles feed along the entire river in July, while between 80 to 100 birds use the upper river in November. Annual aerial stream index surveys for brown bear indicate that counts of 20 to 60 animals can be expected on the upper 6 to 10 miles (10 to 16 km) from early July through August. Although public use of the river is relatively light, it is anticipated that the high concentrations of both brown bear and bald eagles that occur on such a relatively small river may become a major attraction for public use in the future.

Dog Salmon Creek is only 6.5 miles (10 km) in length, but drains an area of about 110 square miles (280 km^2), including Frazer Lake. All five species of Pacific Salmon, rainbow/steelhead trout and Dolly Varden use Dog Salmon Creek for spawning or rearing. The total average annual escapement of all the salmon species (1979 to 1984) is estimated to be in excess of 294,000 fish during the even years and 383,000 fish during the odd years. The average annual escapement of sockeye for 1979 to 1984 has been about 260,000 fish. Fish in this drainage provide a food source for seasonal concentrations of both bald eagles and brown bear. An estimated 20 to 50 bald eagles use the upper 2 miles (3 km) of the drainage from late May through June. In addition, about six active eagle nesting sites have been documented along the drainage. Annual aerial stream index surveys for brown bear indicate that 10 to 30 animals use the upper 2 miles (3 km) of the creek. Five to ten animals may be observed on Connecticut Creek, a tributary of the Dog Salmon, during July and August. Public use of the Dog Salmon drainage is relatively light, but it is anticipated that the relatively high concentrations of both brown bear and bald eagles in the Dog Salmon mainstem will become a major attraction for public use in the future.

Uganik Lake is a scenic mountain lake that provides spawning habitat for salmon and key habitat for bears and eagles. The lake also has high recreational values.

Three Saints Bay is of historical significance. This bay was used by Russian fur traders and was the first caucasian settlement in Alaska.

The 88,000-acre (36,000-ha) Mount Glottof Research Natural Area was designated in 1975 to protect alpine feeding habitat for brown bears and to provide an area for future research on this brown bear summer habitat. The area also contains key habitat for mountain goats, and high scenic and recreational values. The second highest mountain on Kodiak Island, Mt. Glottof, is in this area.

The coastal estuaries adjacent to the refuge are extremely important to waterfowl and pelagic birds. It is estimated that up to 150,000 ducks periodically assemble along the coastal areas. The nine most productive estuaries, totaling 8,000 acres (3,200 ha) are Terror Bay, East Arm of Uganik Bay, Spiridon Bay, Zachar Bay, Uyak Bay, Karluk Lagoon, Sukhoi Lagoon, Horse Marine Lagoon and Midway Bay. These systems also serve as key nursery areas for many species of commercial and sport fish.

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The Service has conducted an extensive public involvement program for the Kodiak Refuge Comprehensive Conservation Plan. Beginning in 1983 information about the plan was distributed. Letters soliciting comments were sent to mayors, village council presidents, Native village and regional corporations in the Kodiak region and to various interest groups and concerned individuals.

Public meetings were held in five communities near or adjacent to the refuge and in Anchorage to identify issues for the refuge comprehensive conservation plan. The Kodiak Island meetings were held in Kodiak, Old Harbor, Akhiok, Larsen Bay and Karluk from May 17 to May 24, 1983; the meeting in Anchorage was held on June 7, 1983. Notices of the meetings appeared in the Federal Register, in local newspapers, and over local radio. Results of the initial "scoping" effort were published in a "Summary of Public Meetings."

The village of Old Harbor.

The Service held workshops on March 15-17, 1985, in Kodiak and on March 20 in Anchorage to develop alternatives for Kodiak Refuge. Four planning workshops were also held in villages with lands bordering the refuge: Karluk (April 1, 1985), Akhiok (April 3), Larsen Bay (April 5), and Old Harbor (April 23). These workshops enabled local residents, Natives, recreational users, conservationists, developers, and government agencies to work together to develop a variety of alternatives for the refuges.

THE NON-WILDERNESS ISSUES

The following paragraphs summarize the major non-wilderness refuge issues identified by the public.

Fish and Wildlife

There seems to be general agreement that the fish and wildlife in Kodiak Refuge are key resources. State and local governments, conservationists, professional guides, sport hunters and fishermen, the commercial fishing industry, Native corporations, local residents, and other concerned citizens all attested to the importance of protecting the refuge's fish and wildlife populations and habitats.

Most individuals and groups wanted to see fishing, hunting and trapping continue in the refuge. Hunters and sport fishermen are the primary recreational users of Kodiak Refuge. They want the Service to continue providing opportunities for these recreational uses. Some people stated that additional opportunities should be provided for hunting, such as enhancing access into the refuge.

A few people wanted to eliminate sport hunting or restrict hunting in an area. The conservation groups urged the Service to not manage the refuge just for hunting--they supported managing the refuge for the widest possible spectrum of public benefits associated with wildlife and wildlands. The Service should consider all uses, including nonconsumptive uses such as wildlife viewing and photography, in managing the refuge. The conservation groups further recommended the Service not focus on producing trophy animals or maximum sustained yields, but rather strive for optimum sustainable populations. The Kodiak Audubon Society urged an emphasis be placed on dispersed, low-density public use and on maintaining the naturalness of the recreational experience.

Management of Brown Bear

Old Harbor and Karluk residents were concerned about nuisance bears coming into their villages, eating garbage and fish and threatening the safety of their families. They wanted special permits to harvest these bears. Other Karluk residents wanted bears recognized as subsistence animals so they could use the meat without fear of breaking the law.

Anchorage residents and individuals from outside the state were generally concerned about protecting the bear populations and their habitats. One nonresident stated brown bear was the primary resource of the refuge and should be given preference in management decisions. An Anchorage resident

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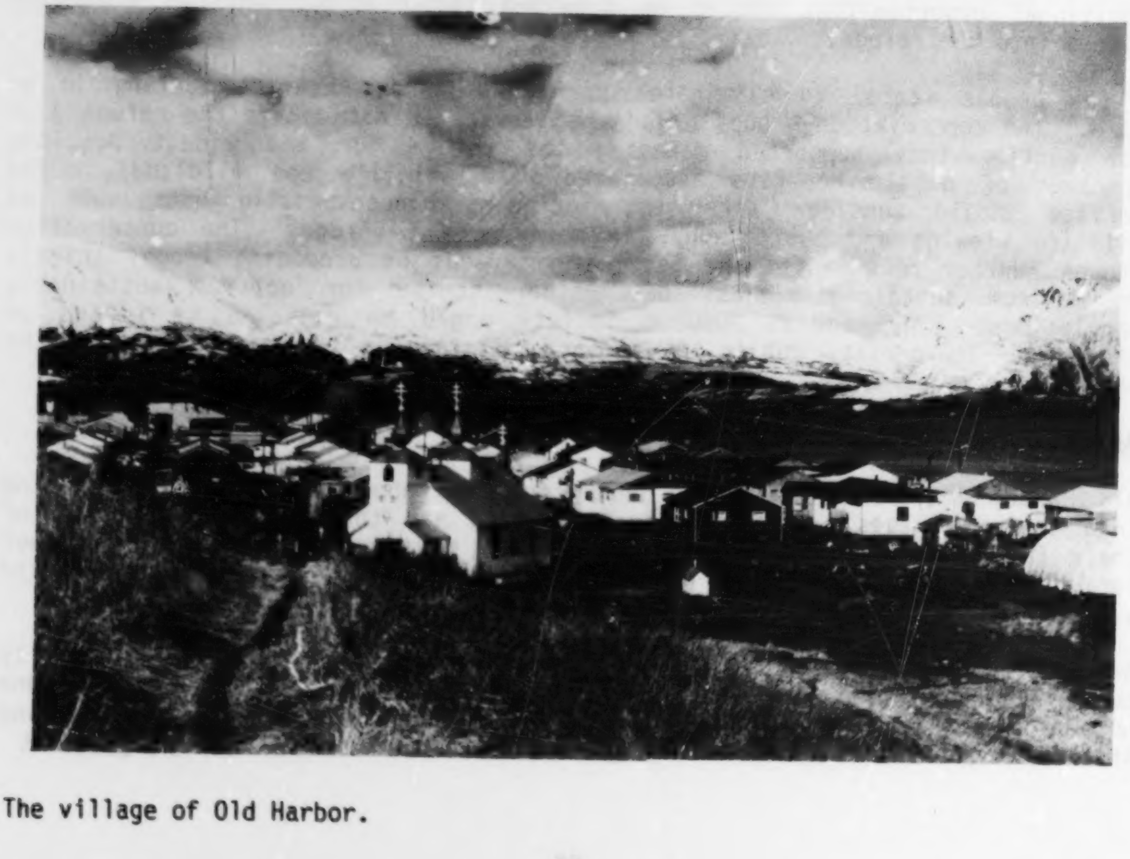

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noted the Service should define the optimal sustainable brown bear population for the island. Some people favored limiting human activity on the refuge to reduce the impact on bears. Disagreement was expressed about whether commercial activities conflicted with the bears or not. The question of kills in defense of life and property (DLPs) also was raised as an issue: should these kills be deducted from the permitted annual harvest? The National Audubon Society supported including non-sport mortality in establishing annual quotas for bear harvests.

Fisheries Enhancement

Residents of Kodiak and Old Harbor expressed the desire to see rehabilitation and enhancement of refuge fisheries. Support was expressed for rehabilitating an unnamed stream in Old Harbor, streams near the Uganik East Passage, and the Viekoda and Kiliuda salmon fisheries, and for building a hatchery at Three Saints Bay. One Kodiak resident stated the Service should support ADF&G commercial fisheries efforts (e.g., rehabilitation projects at Thumb Lake). Another Kodiak resident observed there are too many restrictions on facilities for current fishery management in the refuge. On the other hand, a resident of Karluk noted there is an excess of fish and that additional hatcheries are not needed. The National Audubon Society and Alaska Wildlife Alliance also stated fisheries enhancement is incompatible with the purposes of the refuge.

Wildlife Studies

Both Anchorage residents and the conservation groups noted the need to collect more data on wildlife in the refuge. One Anchorage resident recommended brown bear research have a high priority, specifically to determine harvest quotas. Another person wanted the Service to monitor impacts of people on bears, with emphasis on the effect of people on bear feeding behavior. The National Audubon Society and Alaska Wildlife Alliance recommended that: baseline studies be done on both terrestrial and aquatic communities; all wildlife on the island be studied, with emphasis on wilderness-dependent species; and a comprehensive visitor study be conducted. The Kodiak Audubon Society recommended a comprehensive biological program be developed for the refuge, including expanded studies of ecological processes in subarctic ecosystems, brown bear ecology, fisheries, and nongame species.

Management of Mt. Glottof RNA

Concerns over the management of the Mt. Glottof Research Natural Area (RNA) were raised several times in the meetings. Confusion was expressed about the purpose of this area. One person stated that a distinction should be made between wilderness and research natural areas. A couple of people urged the Service to maintain the current condition of the natural area. They believed the area has a value separate from wilderness areas (i.e., it allows for scientific study of wildlife studies with minimum human impact). Other people stated the area was not needed for brown bear study, and that if a research natural area is necessary it should be limited in size. Some hunting guides were concerned about whether they could continue to hunt in the area. One guide observed half of the bears his clients harvest are within the boundaries of the research natural area. Another hunter noted bears move in and out of the area, so it is impossible to have a non-hunted population of bear.

Regulation of Use and Law Enforcement

Residents of several villages stated there was a need for additional law enforcement in the refuge. Problems noted included: littering, trespass on private lands, illegal use of public cabins, wanton waste of deer meat by nonlocal hunters, vandalism of private cabins, and illegal harvests (e.g., taking over the bag limits, bear hunters hunting illegally without guides). A Kodiak resident urged better regulation and enforcement is needed for sport fishing, particularly on the Ayakulik/Red and Karluk rivers. A Kodiak air taxi operator stated there needs to be more enforcement during the sport fishing season on the Karluk. The National Audubon Society noted that both state and federal enforcement needs to be strengthened by giving emphasis to preventive enforcement.

Other local residents, however, were opposed to certain refuge regulations. For instance, commercial fishermen did not believe that their activities should be restricted. Residents of Akhiok stated that regulations should not prevent them from subsistence hunting for food.

Access

Several Kodiak and village residents and Anchorage residents urged the Service to allow no additional motorized access in the refuge, such as jet boats and three-wheelers. A Kodiak guide stated that access to refuge lands should be allowed to continue by boat, foot and float plane. Opposition was also voiced to constructing roads and trails in the refuge. The Kodiak Audubon Society favored prohibiting permanent roads and trails, and prohibiting helicopters and ORVs unless specifically authorized under special use permit for designated routes and areas. Residents of Karluk stated planes should not be allowed to land at Karluk Lake. Anchorage residents noted heavy use of aircraft is interfering with the aesthetic qualities of the refuge, and better enforcement is needed of existing regulations regarding low flying aircraft.

Subsistence and Quality of Life

Local residents considered subsistence to be important in their way of life, and stated it should be addressed in the plan. They were concerned about increasing numbers of nonlocal hunters and fishermen coming into the refuge, competing for fish and game, and affecting their way of life. A Karluk resident expressed concern about the increasing number of deer hunters on the island. Residents of Old Harbor, Ahkiok, Karluk and Larsen Bay all expressed concerns about sport fishermen dominating the Karluk River and other streams, and causing problems such as litter. A Larsen Bay resident suggested king salmon bag limits be lowered to one per day and one in possession to reduce the number of "meat hunters." Another resident of Old Harbor expressed the sentiment that sport fishermen and hunters have little respect for the land. The Larsen Bay Tribal Council was noted to have outlawed trapping by people from outside the village on their lands.

Public Use Cabins

Public sentiments were mixed on the refuge public use cabins. Some local residents wanted more cabins on the refuge for public use or to upgrade the existing cabins, while others didn't want any additional cabins. A couple Old Harbor residents didn't want public use cabins around their village--they wanted the cabins kept on the west side of the island. Larsen Bay residents advised the Service to take better care of existing cabins before it builds more. A non-local resident also noted the high cost of building and maintaining new cabins and trails in the refuge. Several problems were associated with the cabins, including increased garbage and overuse of the areas around the cabins. A Kodiak bear guide observed that whenever a recreational cabin is built the wilderness gets abused. Another bear guide thought the cabins were needed for public safety purposes, but opposed the construction of additional cabins near Terror Lake. The Alaska Wildlife Alliance was opposed to the construction of visitor facilities that would concentrate visitor activities. The National Audubon Society stated under no circumstances should any public use cabins be built until the Service has completed a management plan.

The Little River Lake public use cabin.

Visitor Education

Residents from Kodiak, Larsen Bay and Anchorage stated there was a need to provide the public with more information about refuge resource values. This was necessary to increase public awareness about the refuge. Information is also needed for visitors to know what supplies and equipment they need and to minimize their impacts on fish and wildlife. The National Audubon Society recommended the Service develop a public information and education program to promote an appreciation of refuge values and to convince visitors of the need to abide by refuge rules and regulations. Hunters need to be educated on how to better deal with bear encounters. The Alaska Wildlife Alliance and Kodiak Audubon Society also encouraged the promotion of an extensive education and interpretive program.

Guiding

Generally the local residents supported the activities of the bear guides. A couple Ahkiok residents noted people hunting bear without guides have left wounded animals. One resident believed even Alaskans should have guides if they come from outside the local area. The Kodiak Island Borough endorsed brown bear guiding.

Some opposition was expressed regarding guide cabins and permanent camps. Both the Kodiak Audubon Society and National Audubon Society were opposed to the granting of additional permits for sport fish guiding cabins or tent frames. The Kodiak Audubon Society stated commercial fishing should be allowed, but not out of semi-permanent camps. A Kodiak resident also voiced opposition to all permanent camps, especially those operated by sport fish guides. Other Kodiak residents, however, supported sport fish guides and other commercial operators being able to build cabins to accommodate guests.

Several local residents wanted sport fish guiding more controlled and also wanted more opportunities to realize economic benefits from guiding. One Ahkiok resident wanted people in his village to have the chance to guide for brown bear hunters. A Kodiak resident wanted local sport fishing guides to have preference over nonlocal guides for permits. Other residents from Karluk and Larsen Bay wanted not more than one sport fish guide on the Karluk River.

Residents in Kodiak and Larsen Bay expressed opposition to having sport fish guides meet the same requirements as brown bear guides--it would be too great a hardship and is unnecessary. But one resident also said there should be some requirement for proficiency to insure the safety of the clients. A Kodiak set netter also stated sport fish guides should be required to have guiding licenses for safety and ethical purposes.

Commercial Fishing and Set Net Cabins

There was sharp disagreement among the various interest groups on the presence of the set net cabins on the refuge's coastline. It was pointed out that the Service needs to establish clear policies for management of private cabins.

Some local residents stated commercial fishing activities should not be restricted and the Service should support commercial fishing in the plan. Set net fishermen opposed restrictions on the use of cabins, including seasonal limits, and complained that cabins with an area of 400 square feet (37 m^2) was too restrictive. They also wanted the Service to permit expansion of existing facilities and the construction of new cabins for commercial fishing. A fishermen further recommended cabin permits be issued to those users who responsibly tented at the same site for 2 to 3 successive years. The Citizens Advisory Commission on Federal Areas noted it is not feasible to live and work out of a tent for 2 1/2 months on Kodiak. The inability of fishermen to construct storage buildings or additional living facilities, the Commission pointed out, could severely curtail fishing. The Commission favored fishermen being able to check on their cabins and gear, and expand their facilities--expansion of facilities will not impact the bears as much as deer and bear hunters.

On the other hand, residents of Ahkiok expressed resentment about set netters fishing in the refuge--the Ahkiok residents wanted the opportunity to fish or partake in the benefits. Anchorage residents and the conservation groups argued for limiting use of the cabins, expressing concerns about the impacts of human activities on bears and other fish and wildlife. The Kodiak Audubon Society did not want any additional special use permit cabins on the refuge. The National Audubon Society advised the Service to inventory and evaluate the existing cabins and determine if they are compatible with the purposes for which the refuge was established; if they are compatible, nontransferable lifetime permits should be considered. The group was not in favor of expanding the seasonal occupancy of existing cabins. A Kodiak bear guide and several other people stated the Service should not allow additional private cabins on the refuge.

Hydroelectric Development

Different views were expressed on the development of hydroelectric projects in the refuge. A resident from Kodiak supported small projects around the villages, particularly at Larsen Bay and Old Harbor. An Ahkiok resident also favored hydroelectric development if it would reduce local electricity costs. On the other hand the conservation groups and other local residents were opposed to additional hydroelectric development in the refuge. A Kodiak bear guide was opposed to hydro development because of the disturbance of the aesthetics. A commercial set netter was critical of additional projects after the Terror Lake project. Additional development in the Mount Glottof RNA was opposed by the National Audubon Society and a couple of nonlocal residents.

Other Economic Activities

In general, people wanted to maintain the refuge in its present condition. The National Audubon Society urged all proposed development activities be studied on a case-by-case basis to determine if they are compatible with the purposes of the refuge. An Anchorage resident stated the Service should limit commercial development to reduce impacts on brown bear habitat. Grazing of domestic livestock on the refuge was opposed by the National Audubon Society, Kodiak Audubon Society and residents from Kodiak and Anchorage--this use was noted to be incompatible with refuge purposes. Oil and gas development and mining also were opposed by most people who commented on this topic.

Land Exchanges and Inholdings

Private inholdings in the refuge were of concern to Anchorage and Kodiak residents and the conservation groups. Indeed, the Kodiak Audubon Society viewed the inholdings as the most serious threat to the future well being of the refuge. Several Kodiak residents stated land exchanges with Koniag Regional Native Corporation should be considered in the plan. One person noted lands transferred to Koniag would impact the refuge. Another resident stated land exchanges would give the refuge back its land and restore economic viability to Koniag. The Kodiak Audubon Society encouraged land exchanges and acquisitions that would eliminate private inholdings and consolidate refuge lands.

Koniag officials urged the Service to give full recognition to inholdings in the plan, and to develop refuge rules and regulations for Native village corporation inholdings.

Residents of Old Harbor, Ahkiok, Larsen Bay and Anchorage expressed concern about visitors trespassing on Native lands. Land status was noted to be confusing. People frequently trespass because they don't know they are on private land. Anchorage residents requested the Service to clarify land ownership and delineate the location of private lands.

Refuge Management

Local residents generally expressed satisfaction with the management of the refuge and its fish and wildlife resources. Indeed, one bear guide stated Kodiak has the best game management in the state. Questions were raised, however, about the sensitivity of the refuge staff to local concerns. An Ahkiok resident stated the village needed clarification of the relationship between the Natives, third parties, and the refuge.

The need for more coordination with both the local communities, ADF&G, and adjacent land owners was also brought up. Residents of Old Harbor wanted an individual from each village appointed to work as an advisory committee on the refuge plan. Another person said the tribal councils should appoint people to an advisory committee to insure consideration of Native interests. An Ahkiok resident stated the refuge staff should work directly with Akhiok people, not through Koniag.

WILDERNESS DESIGNATION ISSUES

This document includes the Service's proposals for wilderness designation in Kodiak Refuge. Designating wilderness is a major federal action, affecting resources, users, recreational activities and facilities, economic uses, and refuge management. Based on the issues raised by the refuge users, the state, local residents, and other interest groups, the Service identified 19 potential issues related to wilderness designation. The Service determined that one issue is significant, based on criteria set forth in the Council on Environmental Quality's NEPA regulations (40 CFR 1508.27). This issue is addressed both in the management alternative and environmental consequences chapters:

- What will be the impact of designating wilderness on the refuge's fish and wildlife habitats and populations?

This issue is significant because of the degree to which wilderness designation will affect the future of wildlife in the refuge, the quality of the human environment, and the degree to which controversy is generated by either designating areas or not taking any action. One of the purposes of Kodiak Refuge is to conserve fish and wildlife populations and habitats. Designating wilderness is advocated to permanently protect the unique combination of populations and habitats in Kodiak Refuge. Studies have shown that certain species, such as tundra swan and brown bear, depend at least in part on wilderness type environments. Wilderness designation would require the Service and other management agencies to use the "minimum tool" concept. This should not interfere with satisfying management objectives for the refuge, although some management practices would not be used in the wilderness area. Wilderness designation also will prevent potential impacts to fish and wildlife that could occur from developments, such as roads, hydroelectric facilities, and oil and gas facilities.

The Service determined that 18 other issues related to wilderness designation did not satisfy the NEPA criteria for significance, and therefore did not address them in this document. Many of these issues involve uses that would not be permitted anywhere in the refuge, regardless of the wilderness designation, because they would not be compatible with refuge purposes. The issues were as follows:

- What impact will wilderness designation have on the level of commercial logging?

The Afognak Island unit has stands of Sitka spruce, some of which probably have commercial value. However, these stands are scattered and are in rugged country. It probably is not feasible economically to log the stands and transport the timber to a mill. Wilderness designation of the unit would prohibit commercial logging. The issue is considered to be not significant because logging has not been proposed for the area, there are other Sitka spruce stands on Afognak Island that could be logged, and the public did not raise this as a major issue during the scoping meetings held by the Service in developing this plan.

- What impact will wilderness designation have on the development of new hydroelectric facilities?

Several small hydroelectric projects have been studied in the refuge. These projects would be located on Native lands and would not be affected by the wilderness designation. Expanding the Terror Lake hydroelectric project into the upper Uganik watershed has also been studied. Wilderness designation would prohibit new hydroelectric developments. The issue is considered to be not significant because the existing Terror Lake facility is expected to satisfy future load requirements (FERC, 1981)(and then another generator could be added to the existing facility), and another feasible hydroelectric facility has not been proposed on Service lands.

- What impact will wilderness designation have on oil and gas exploration and development in the refuge?

Wilderness designation would preclude oil and gas exploration and development. In the case of Kodiak Refuge, this is not an issue because the refuge has not been identified to have oil and gas potential.

- What impact will wilderness designation have on the development of mining claims?

This is not an issue because there are no valid mining claims on Kodiak Refuge. Also, Section 1110 of ANILCA assures miners access to develop their claims in all conservation system units, including wilderness areas:

> Notwithstanding any other provisions of this Act or other law, any case in which...subsurface rights of...owners underlying public lands, or a valid mining claim or other valid occupancy is within or is effectively surrounded by one or more conservation system units the...private owner or occupier shall be given by the Secretary such rights as may be necessary to assure adequate and feasible access for economic and other purposes to the concerned land by such...private owner or occupier and their successors in interest. Such rights shall be subject to reasonable regulations issued by the Secretary to protect the natural and other values of such lands.

- What impact will wilderness designation have on the development of roads and other transportation corridors?

This is not a significant issue for Kodiak Refuge because no proposals have been made to build transportation corridors through the refuge. If wilderness is designated in the refuge, a transportation corridor could still be built through the wilderness area, subject to the provisions of Title XI of ANILCA.

- What impact will wilderness designation have on the level of activities and facilities of commercial fishermen?

Commercial fishermen have cabins and other support facilities on refuge lands that could be within proposed wilderness areas. Wilderness designation would not affect the rights of commercial fishermen to use the refuge. Section 304 of ANILCA states:

> The Secretary shall permit within units of the National Wildlife Refuge System designated, established, or enlarged by this Act, the exercise of valid commercial fishing rights or privileges obtained pursuant to existing law and the use of Federal lands, subject to reasonable regulation, for campsites, cabins, motorized vehicles, and aircraft landings directly incident to the exercise of such rights of privileges: Provided, That nothing in this section shall require the Secretary to permit the exercise of rights or privileges or uses of the Federal lands directly incident to such exercise, which he determines...to be inconsistent with the purposes of a unit of the National Wildlife Refuge System...and to be a significant expansion of commercial fishing activities within such unit beyond the level of such activities during 1979.

- What impact will wilderness designation have on the construction of new recreation facilities such as cabins?

Existing public use cabins could be kept and a limited number of new cabins and shelters could be built in a designated wilderness under Section 1315 of ANILCA:

> Previously existing public use cabins within wilderness designated by this Act, may be permitted to continue and may be maintained or replaced subject to such restrictions as the Secretary deems necessary to preserve the wilderness character of the area.
> Within wilderness areas designated by this Act, the Secretary...is authorized to construct and maintain a limited number of new public use cabins and shelters if such cabins and shelters are necessary for the protection of the public health and safety. All such cabins or shelters shall be constructed of materials which blend and are compatible with the immediate and surrounding wilderness landscape.

- What impact will wilderness designation have on the development of visitor interpretive facilities?

This is not a significant issue because there are no proposals to build such facilities in the refuge. Section 1306 of ANILCA also would permit visitor facilities in any conservation system unit, including wilderness:

> In conformity with the conservation and management plans prepared for each unit and the purposes of assuring the preservation, protection, and proper management of any conservation system unit, the Secretary may establish sites and visitor facilities-
> (1) within the unit, if compatible with the purposes for which the unit is established, expanded, or designated by this Act, and the other provisions of this Act....

- What impact will wilderness designation have on the level of subsistence activities?

One of the primary purposes of Kodiak Refuge, under Section 303 of ANILCA, is to provide for continued subsistence uses by local residents. The Service would take no actions that would adversely affect this use. Wilderness designation would not restrict hunting, fishing or trapping, or access for this use.

- What impact will wilderness designation have on the level of recreational hunting and fishing?

Fish and Wildlife Service regulations (50 CFR 35.6) state that hunting and fishing would continue to be permitted in a refuge wilderness:

> Public uses of a wilderness unit will be in accordance with the purposes for which the individual national wildlife refuge was established and is administered and laws and regulations governing public uses within the National Wildlife Refuge System....
> Hunting and fishing in a refuge wilderness will be in accordance with Federal and State regulations including special regulations for the specific wildlife refuge....

If a wilderness area were designated on Kodiak Refuge, the designation would have no bearing on the hunting and fishing regulations issued by the Alaska Boards of Fish and Game for the refuge.

- o What impact will wilderness designation have on the activities of guides and outfitters?

Guiding activities would continue to be regulated by the Alaska Guide Licensing and Control Board and the Boards of Fish and Game irrespective of the designation. Under Section 1316 of ANILCA guides and outfitters are allowed on all public lands, including wilderness areas:

> On all public lands where the taking of fish and wildlife is permitted in accordance with the provisions of this Act or other applicable State and Federal law the Secretary shall permit, subject to reasonable regulation to insure compatibility, the continuance of existing uses, and the future establishment, and use, of temporary campsites, tent platforms, shelters, and other temporary facilities and equipment directly and necessarily related to such activities. Such facilities and equipment shall be constructed, used, and maintained in a manner consistent with the protection of the area in which they are located.

Fish and Wildlife Service regulations (50 CFR 35.6) also permit the use of temporary structures by outfitters and guides in a wilderness area:

> Public services and temporary structures generally offered by...outfitters and guides for realizing the recreational or other wilderness purposes of a wilderness may be permitted.

Wilderness designation would preclude the development of permanent facilities by guides or outfitters or the use of motors, but this is not an issue on Kodiak Refuge because no permanent facilities or motors are used by guides or outfitters.

- o What impact will wilderness designation have on the use of ORVs?

ORVs, including three-wheelers and air boats, would not be permitted in a designated wilderness (or any other federal lands) in Kodiak Refuge, unless it was a traditional use prior to the passage of ANILCA, under Fish and Wildlife Service regulations (50 CFR 36.22). This is not an issue on Kodiak Refuge because the only use of ORVs within the refuge boundary occurs on Native lands--these lands would not be included in a wilderness proposal.

- o What impact will wilderness designation have on the use of snowmachines, airplanes, or motorboats?

Section 1110(a) of ANILCA permits the uses of these vehicles on all conservation system units, including wilderness areas:

> Notwithstanding any other provision of this Act, or other law, the Secretary shall permit, on conservation system units...the use of snowmachines (during periods of adequate snow cover...), motorboats, airplanes, and nonmotorized surface transportation methods for traditional activities (where such activities are permitted by this Act or other law) and for travel to and from villages and homesites. Such use shall be subject to reasonable regulations by the Secretary to protect the natural and other values of the conservation system units...and shall not be prohibited unless, after notice and hearing in the vicinity of the affected unit or area, the Secretary finds that such use would be detrimental to the resource values of the unit or area....

Traditional uses on Kodiak Refuge would include recreational uses.

- What impact will wilderness designation have on fisheries management activities and structures?

Wilderness designation in and of itself does not affect fisheries management activities--so long as as the action is compatible with the purposes of the refuge it could be permitted in a wilderness area. Under Section 304(e) of ANILCA:

> Where compatible with the purposes of the refuge unit, the Secretary may permit, subject to reasonable regulations and in accord with sound fisheries management principles, scientifically acceptable means of maintaining, enhancing, and rehabilitating fish stock.

Service policy is that actions essential to accomplish refuge management objectives, such as fish stocking, could be permitted in a wilderness area. The "minimum tool" criterion will apply to all management actions. Temporary facilities could be built, if compatible with refuge purposes, in a wilderness area. Under Section 4(c) of the Wilderness Act permanent facilities would not be permitted in a wilderness area. However, most fishery management actions that would need to be taken on Kodiak Refuge could be accomplished using temporary facilities. The issue is not considered to be significant because there are other options that can be pursued to accomplish management objectives without building a permanent facility in a wilderness area, and a permanent facility has not been proposed in the refuge.

- What impact will wilderness designation have on habitat manipulation?

Wilderness designation does not rule out habitat manipulation as a management activity--so long as as the action is compatible with the purposes of the refuge it could be permitted in a wilderness area. Service policy is that facilities essential to accomplish refuge management objectives may be permitted in a wilderness area. The "minimum tool" criterion would apply to all habitat management actions, such as using motorized equipment. Mechanical manipulation would not be permitted in a designated wilderness.

- o What impact will wilderness designation have on fire suppression activities?

Wilderness designation would not change the Service's fire management direction, as outlined in this plan, for controlling wildfires on Kodiak Refuge. Service regulations (50 CFR 35.7) provide for controlling wildlfires as well as insects, pests, plants, and disease:

> To the extent necessary, the Director shall prescribe measures to control wildfires, insects, pest plants, and disease to prevent unacceptable loss of wilderness resources and values, loss of life, and damage to property.

- o What impact will wilderness designation have on the management and use of the Mt. Glottof Research Natural Area?

The issue people are concerned with is how the RNA will be managed, and what uses will be allowed in the area. (See the previous discussion of the Mt. Glottof RNA in this chapter.) This is not a significant issue because wilderness designation does not affect how the Service will manage this area--the management objectives of the research natural area will affect how the Service manages this area, regardless of whether the area is a wilderness or not. The same uses would be permitted in the RNA as in the minimal management areas (e.g., hunting, fishing, wildlife observation, oil and gas exploration).

- o What impact will wilderness designation have on the level of use of Native selected lands and 22(g) lands?

No lands within the Kodiak Refuge boundary would be proposed for wilderness designation that have been conveyed. Selected lands may be shown as proposed for wilderness designation in this document, but would not be submitted in a proposal to Congress until the land status of the areas has been settled.

STATE OF ALASKA POLICY POSITION PAPER

Early in 1984 the State of Alaska provided the Service with a policy position paper for Kodiak Refuge and surrounding area. While this paper covers a broad spectrum of issues of concern to all state agencies, most recommendations are related to management of fish and wildlife resources. The paper identifies the state's current management policies and objectives, notes management issues, and recommends solutions. The issues addressed range from public access to refuge resources and the need for more research on fish, wildlife, and habitat management.

A liberal approach to public access was advocated by the state. All refuge roads, trails, waterways, and aircraft landing areas that are now open should remain so. Access by the public, private landowners and the state should not be restricted. Cabins on the refuge should remain available for public use, and should be maintained.

The Service was requested to not rule out potential power projects in the refuge. Areas associated with power project development and transmission corridors should be cooperatively planned by both federal and state agencies.

The importance of protecting key wildlife areas, such as spawning areas, mineral licks, denning or fawning areas and stream confluences, was pointed out. Any resource exploration or development activities, or the development of refuge facilities (such as campgrounds, trails, or roads) should be avoided in these areas.

The state advocated maintenance of its prerogative to carry out fisheries enhancement and conduct future investigations on the refuge. ADF&G Fisheries Rehabilitation, Enhancement and Development (FRED) Division projects on Karluk Lake and Frazer Lake should continue to be permitted. The agency's ability to conduct aerial, ground, or boat surveys of fish and wildlife (including the use of helicopters) should not be unduly restricted by cumbersome permit requirements. It should be allowed to erect and maintain any facilities or structures needed for fish and wildlife management. Clarification of Section 304(d) of ANILCA, regarding what constitutes a significant expansion of commercial fishing activities, was also requested.

The state stressed its responsibilities for maintaining fish and wildlife populations and regulating use of fish and wildlife on the refuge. It requested that the Service adopt management plans that are in substantial agreement with state brown bear, deer, elk, mountain goat, furbearer, small game, waterfowl, and unclassified game management plans. The state also recommended a legal clarification be made on the ownership of the feral reindeer herd in the Red Lake-Ayakulik/Red River area so that a decision can be made on whether to remove the reindeer or manage the herd.

Commercial big game guiding should be allowed to continue on the refuge. Changes in regulations that would affect the guiding industry should be reviewed by the state Guide Board and members of the guiding industry before being implemented.

Potential bear/human conflicts were noted to be a concern in the refuge. The state recommended continued hunting, visitor education programs and control of garbage and other attractants on inholdings to minimize these problems. The impracticality of transplanting problem bears was also noted: the state will not allow the transplant of problem bears to areas outside of the refuge boundaries.

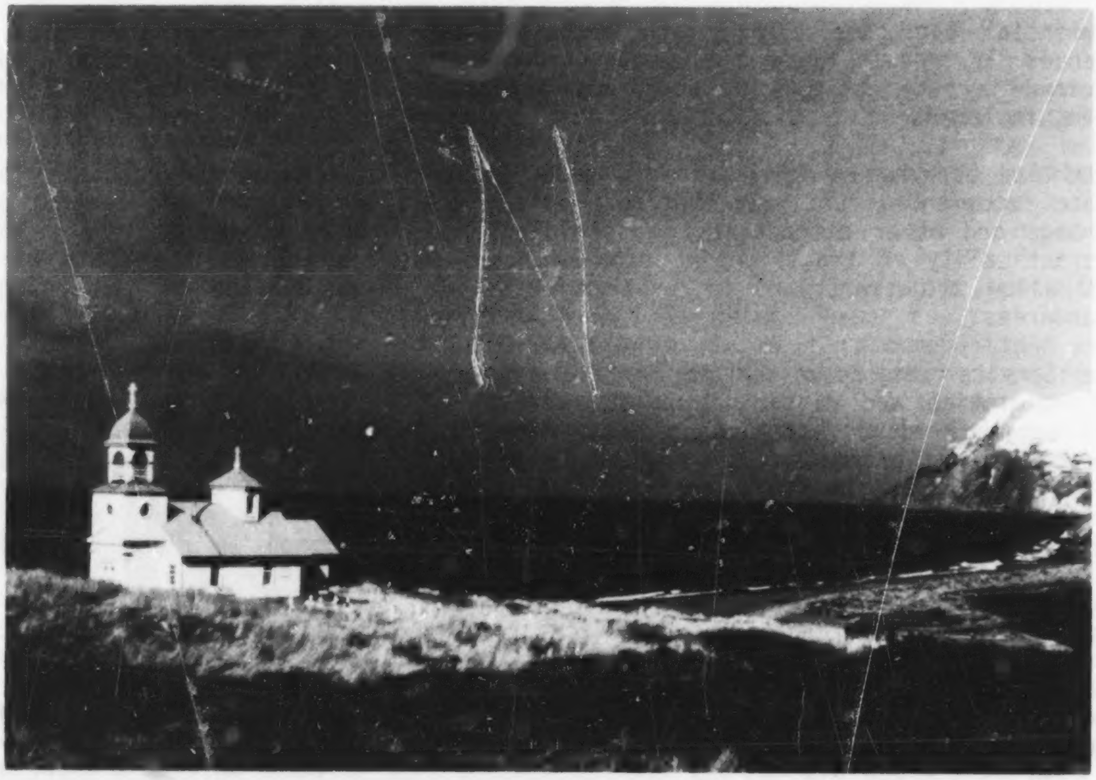
The Service was requested to cooperate with the state in the collection, interpretation and dissemination of research data, statistical data, banding and tagging records, population data, census information, harvest tabulations and other use information for fish and wildlife in Kodiak Refuge. The Service was requested to maintain opportunities for the state to conduct research projects on the refuge. One specific research need identified by the state was to be able to census or survey bears accurately without using visual tags or collars.

Regarding public information, the state stressed the Service should cooperate with the state in preparing publications on refuge resources and their use. These publications should explain to the public that consumptive use of fish and wildlife are compatible with ecosystems management and will be allowed on the refuge.

Throughout its recommendations, the state urged the Service to cooperate with ADF&G and other state agencies in managing the refuge, its resources and users. The Service was requested to cooperate with the state in conducting power project studies, monitoring developments, ensuring access, managing water, historical, and fish and wildlife resources, monitoring subsistence use, conducting research, identifying areas where adjustments in the refuge boundary should be made, and preparing publications about the refuge. Working together on these and other topics would be to the benefit of both the state and the federal governments.

FUTURE PUBLIC INVOLVEMENT

The public may submit comments on this draft comprehensive conservation plan/EIS during a 90-day review period that will follow its publication. Public meetings will be held in villages on Kodiak Island and in Anchorage to receive comments. Following the close of the public comment period, the plan will be revised and published as a final plan/EIS. Thirty days following publication, the Service may issue a record of decision which describes the alternative or combination of alternatives to be implemented. Additional opportunities for public review and comment will be provided as the plan is updated.



The Russian Orthodox Church in the village of Karluk.

IV. POTENTIAL PROBLEMS AFFECTING FISH, WILDLIFE AND HABITATS

IV. POTENTIAL PROBLEMS AFFECTING FISH, WILDLIFE, AND HABITATS

Section 304 of ANILCA requires the Service to identify and describe significant problems that may adversely affect refuge fish and wildlife, and their habitats. The Service identified ten potential problems for Kodiak Refuge.

DEVELOPMENT AND USE OF EXISTING COMMERCIAL AND PUBLIC USE FACILITIES WITHIN THE REFUGE

Permanent facilities within the refuge boundary are affecting, or have the potential to affect, refuge resources and habitats. In 1984 there were 65 set gillnet fishing sites under permit on refuge and Native lands within the refuge boundary (54 of which have cabins and 10 of which have tent frames that must come down at the end of the season of use but may be stored on-site), about ten permitted commercial guide camps on refuge and Native lands (of which nine have cabins and one has a tent frame), and the Terror Lake Hydroelectric Dam and related facilities. There are also nine public use cabins on refuge lands and two cabins on Native lands within the refuge boundary. The construction and maintenance of these structures directly affects the physical habitat. The facilities also concentrate human use at specific locations, resulting in indirect impacts such as disturbance or displacement of wildlife, destruction of vegetation, litter, and degradation of water quality.

In the future different user groups probably will request the expansion of existing facilities or the construction of new facilities. In particular, commercial fishermen would like to expand their existing structures. Some users would like to expand the refuge's public use cabin system to accommodate more users. Commercial guide or outfitter camps that encounter bear problems probably will request to build a cabin "for protection of clients." In addition, fishery management structures, oil and gas staging facilities, navigation aids, transmission lines, and hydroelectric projects may be built in the refuge (see below). All of these structures have the potential to adversely affect, both directly and indirectly, habitats, fish and wildlife populations, and user groups.

Commercial users are also becoming more concerned about vandalism and damage to gear stored in their cabins. This has prompted some fishermen to propose stationing year-round watchmen at their cabins. Longer term occupancy of the cabins could potentially conflict with bears and other wildlife that use the coastal areas, and could interfere with access by the general public.

DEVELOPMENT AND USE OF PRIVATE INHOLDINGS AND ADJACENT LANDS

Several categories of private inholdings exist within Kodiak Refuge. Over 300,000 acres (121,000 ha) of former refuge lands, nearly one-fifth of the refuge, has been conveyed to Native village corporations under provisions of the Alaska Native Claims Settlement Act (ANCSA). These lands include a considerable portion of the best brown bear habitat in the refuge, several key salmon spawning streams, and at least one heavily used recreational area (Karluk Lake and River). Widely scattered lands also have been selected under Section 14 of ANCSA as primary places of business or residence.

Applications for 150 Native allotments within the refuge, totaling about 10,000 acres (4,000 ha) have been filed with the BLM. These widely scattered small parcels, all but one of which are located in coastal areas, cover many of the key access points in the refuge. The status of the allotment claims is uncertain, and it is not known how many applications will be approved.

There are 87 private patented parcels in the coast areas of the refuge, totaling about 1,400 acres (570 ha). One 318-acre (129-ha) tract near the head of Uyak Bay, providing key bear habitat, has recently been subdivided. A major development in this area could cause serious impacts in this high density bear area.

Finally, eight one-square mile (3-km^2) village sites were excluded from the refuge when it was established in 1941. The likelihood of development is low on two of these sites, while the remaining sites are developed near their potential.

A commercial fisherman's set net site and cabin.

Use and development of private property within and adjacent to the refuge can impact bears and other wildlife populations, and habitats on the refuge. Many wildlife species regularly move on and off refuge lands. Bear problems in the villages have been increasing in recent years. As these villages become larger the level of bear problems will undoubtedly increase. At some point it is possible that bears may be substantially reduced in numbers around the villages, as has occurred near the city of Kodiak.

Destruction of habitats on adjacent lands may adversely affect wildlife populations in the refuge. Commercial developments on adjacent lands could adversely affect the refuge's scenic, wilderness, air, and water resources. The accessibility of the refuge could increase if nearby property is developed, complicating protection of resources and visitors. Predation by domestic or feral animals (such as dogs) on wild animals also will probably increase. Furthermore, diseases can be transmitted from domestic animals to wildlife and vice-versa (Peterson and Woolington, 1981).

Public access across private lands also presents a potential problem. Conveyance of the Native Allotments and additional lands under ANCSA along the coastline may make access to interior areas extremely difficult or impossible in some cases due to the strategic location of these allotments and land selections. The areas selected are for the most part traditional access points and anchorages such as beaches and coves. Hunters, trappers, fishermen, and other recreationists who formerly used these access points to reach interior areas may now find themselves in trespass when trying to reach the interior. Although the BLM provides the opportunity to establish easements for public access on most of these land conveyances, it may be difficult for user to attempt to locate the easements--potential conflicts between the public and Native landowners might result.

IMPACTS DUE TO INCREASING PUBLIC USE

Public use of Kodiak Refuge is not as intensive as on many refuges outside of Alaska. However, fish and wildlife populations and habitats in subarctic environments such as those of Kodiak Refuge are more sensitive to human disturbance than those in milder climates because of the short growing season and long, harsh winters. Flora and fauna can take decades or even centuries to recover completely once natural conditions are disrupted.

In recent years public use of the refuge's major river systems and lakes has increased. The Karluk River and Karluk lake areas are currently receiving accelerated public use, and use is increasing on the Ayakulik/Red drainage, Uganik Lake and Frazer Lake. As public use increases in these areas the potential for degradation of water quality and damage to sensitive riparian habitats, tundra, and spawning beds, will increase.

Increasing public use and commercial activities affect fish and wildlife populations directly as well as indirectly. Increased human presence in an area generally causes a decreased use of that area by some species, particularly those species that occur more often in wilderness-type habitats like brown bear and tundra swans. Some of the more popular river systems in the refuge have drainages ranging from 100 to 200 square miles (259 to 518 km^2) with mainstream water courses of less than 25 river miles (40 km).

Some of the highest densities of brown bears and bald eagles per unit area in North America are found in these drainages during the salmon runs. High public use levels during key periods can disturb animals or cause them to leave their favored feeding areas for less productive areas. The problem of determining limits of public and commercial use in those areas which provide sensitive habitat for bears and other wildlife during key high density periods will be a major issue in the future.

Increasing public use is also probably responsible for increased kills of brown bears in defense of life and property (DLPs). Next to sport hunting, DLPs are the primary cause of bears killed by people on Kodiak Island. Annual reported DLP mortality has increased over the past eight years, going from 2.0 for the period 1976-1979 to 4.3 for 1980-1983. In 1984, 4 DLPs were recorded on the refuge. With the expected increase in future human activity in the refuge, it is likely that DLPs will increase.

Anglers come to Kodiak Refuge to fish for five species of salmon, steelhead, rainbow trout, and Dolly Varden.

Although the refuge is presently closed to motor vehicles other than airplanes, motorboats, and snowmachines, the increased use and availability of motor vehicles such as jet boats, all-terrain vehicles (ATVs) and hovercraft outside of the refuge has led to more pressure to open the refuge to these types of motor vehicles. Refuge areas in which motor vehicle access is being requested include: Larsen Bay - Portage and Karluk Lake; Viekoda Bay - Port Lions; Red River - Ayakulik beach; and other beach areas such as Seven Mile and Long Beach. The use of motor vehicles, if not carefully managed, can degrade habitat. Motor vehicles can disturb wildlife such as denning brown bears, nesting waterfowl and raptors in areas with heretofore limited access. Trails made by tracked and wheeled vehicles cause erosion, destroy vegetative cover, and disturb adjacent habitat. Air boats and jet boats cause considerable disturbance to wildlife. Jet boats could also potentially disturb salmon spawning beds and spawning fish.

LOSS OF WILDERNESS VALUES

This potential problem stems from all of the previous problems. With more and more people flying into the refuge to fish and hunt deer, increasing numbers of motorboats being used on the refuge drainages, development of commercial set net facilities on the refuge shoreline and guide camps in several locations, the refuge's wilderness values are being eroded. If use continues to increase, the perceptions of overcrowding, overfishing, litter, noise, and water pollution will increase, while opportunities for solitude and primitive recreation will disappear. Development of additional recreational cabins or semi-permanent (season-long) camps by guides and outfitters, or the development of private inholdings in the future also could result in the loss of wilderness values of the refuge.

SUBSISTENCE, COMMERCIAL AND SPORT HARVEST OF FISH

Salmon from the refuge are harvested by commercial, subsistence and sport fishermen. ADF&G regulates this harvest to ensure that enough adults escape to spawn, thus maintaining the fishery. However, an increase in harvest levels by any user group, on or off the refuge, could make fewer fish available. Conflicts could arise between commercial and subsistence fishermen, commercial and sport fishermen, or between sport and subsistence fishermen.

If escapement goals are not met and salmon populations decline as a result, the refuge could be adversely affected. Reduced runs could affect:

- the number of adult salmon that brown bear and other large predators have available as food;
- the ability of a specific fish population to maintain itself;
- the number of salmon carcasses available for scavengers and decomposers that recycle nutrients and maintain the fertility of aquatic habitats;
- the number of fry that various fish, birds, and mammals eat; and
- commercial harvests outside of the refuge.

Commercial fishery management harvest strategies affect the number of spawners and thus the productive potential of the habitat, given favorable environmental conditions. The significance of the relationship between available habitat and the number of spawners that could productively use the habitat has not been assessed for some species on the refuge. This calls for further study.

FISHERY MANAGEMENT ACTIVITIES

Although most fishery management activities are not considered to be a problem, and indeed are necessary to ensure continuance of natural refuge fishery resources, some development projects could cause conflicts in the future. The Kodiak Regional Planning Team has identified an increase of salmon production within the Kodiak region as one of its target goals: the Kodiak Regional Comprehensive Salmon Plan (1984) targeted a 78% increase above current natural runs during odd years and a 49% increase during even years. This would be accomplished by building new hatcheries, stocking barren lakes and fertilizing lakes. Although no specific projects are as yet identified and this percent increase covers the entire Kodiak area, refuge stocks may be affected by future development projects. Strategies to increase production of juvenile salmonids above the carrying capacity of either the freshwater or marine environment may induce intra- and inter-species interactions that have a negative effect on natural stock levels. The end result may be an overall decrease in annual stock returns to refuge streams and a reduction in the commercial fishery harvest.

Fishery development projects that necessitate long-term human habitation in key wildlife habitat on the refuge may result in direct adverse impacts to wildlife populations. Increased human presence in an area generally results in displacement or decreased use by species that require remote, wilderness-type habitats, like brown bear and tundra swans. This human habitation may also result in additional losses to the brown bear population through defense of life and property kills.

CONFLICTS BETWEEN USERS

Public use in Kodiak Refuge is expected to increase over the next ten years. The increase in use affects the quality of the recreational experience. Long term camping at one site may cause overcrowding, habitat degradation, and accumulation of garbage and other bear attractants. As use increases competition increases within user groups and between different user groups for limited resources such as salmon, cabins, or solitude. Competition may be either direct (such as between two boats fishing the same spot) or indirect (such as when fishermen shoot bears in defense of life, reducing the population that bear hunters can harvest). Although competition is at relatively low levels in most instances, the potential exists for the competition to intensify. Competition is already perceived to be a problem by some fishermen: local residents have complained about nonlocal sport fishermen taking too many fish. Competition for bear permits is occurring between local resident, state resident and nonresident hunters. Competition among hunters for deer also could become a problem if a severe winter significantly reduces the island's deer population.

The perceptions of increased competition for resources can result in misunderstandings and increased tensions between user groups. As more and more people visit the refuge the potential for conflicts between the groups will probably increase if other actions are not taken.

GRAZING OF DOMESTIC LIVESTOCK

Cattle grazing has never been permitted on Kodiak Refuge. One permit for reindeer grazing was maintained from the 1920's until the early 1960's when no interest was expressed in renewing it. In the mid- to late 1950's and early 1960's perceived bear/cattle conflicts in the area of municipal Kodiak caused considerable controversy. In 1958, the refuge boundary was modified to exclude the Shearwater and Kupreanof peninsulas so these areas could be opened to livestock grazing.

Livestock grazing within or adjacent to the refuge boundary in the future would result in major problems. Reindeer and cattle grazing would require intensive herding, which could cause further intrusion into prime wildlife habitat. The grazing of these animals in good bear habitat would result in bears becoming "nuisance" animals, as well as increasing the potential for bear-human encounters. This would inevitably result in additional DLPs. Ranchers in the Kodiak area in the past have hunted and killed bears that are seen near their cattle. The reindeer on Kodiak also are suspected to be carriers of communicable diseases that could affect refuge wildlife.

OIL AND GAS STAGING

An oil or gas staging facility could be proposed for development in the refuge if commercial deposits are discovered offshore. Five potential staging sites have been identified in the refuge, only one of which probably would be developed, including Larsen Bay, Three Saints Bay and Alitak Bay. If a facility were built it is expected to load tankers, off-load supplies and provide support facilities for up to 100 workers. The concentrated use and disturbance of the surrounding refuge area by workers and site-related activities, such as heavy use of light, medium and heavy turbine helicopters, and the possibility of environmental contamination from fuel spills would be the major impacts and problems of such a facility. In addition to work-related activities, the workers would probably hunt, fish and engage in other recreational activities on the refuge in their free time, resulting in further deterioration of habitat and disturbance to wildlife in the general area of any such site.

LACK OF RESOURCE DATA

Additional research is needed on refuge resources, the uses people make of these resources, and the effects of uses upon the resources is inadequate for sound scientific management of the refuge. Research has been done on bears, salmon and seabirds, but little is known about many other fish and wildlife species, their habitat requirements, or their sensitivity to human impacts. Information is needed on the national species of special emphasis (NSSEs) that use Kodiak Refuge and adjacent waters, including tundra swan, mallard, bald eagle, and sea otter. Additional research is also needed on brown bears, deer, salmon, invertebrates, and archaeological resources. Information on public, subsistence and economic uses of the refuge, and resulting impacts is particularly scarce. Adequate research and monitoring are required to record baseline conditions, determine management needs, assess potential impacts, and determine actions needed to minimize or avoid impacts.

The Terror Lake hydroelectric dam, completed in 1984, lies within the refuge boundary.

V. AFFECTED ENVIRONMENT

V. AFFECTED ENVIRONMENT

LAND STATUS

The land status of Kodiak Refuge is constantly changing because refuge lands selected by Natives, Native corporations are in the process of being relinquished, invalidated (rejected) or interim conveyed. Proposed land exchanges may cause additional changes in the land status (see the land exchange common management direction in Chapter VI).

Of the 1,865,000 acres (755,000 ha) of land within the refuge boundary, 1,591,000 acres (644,000 ha) or 85% of the land is presently under federal jurisdiction. Fifteen percent of the land within the refuge boundary (274,000 acres or 111,000 ha) has either been patented, interim conveyed or legislatively approved for conveyance to five Native village corporations (Akhiok, Kaguyak, Karluk, Larsen Bay and Old Harbor), individual Natives, and private parties. (This does not include tide lands which are under jurisdiction of the State of Alaska.) About 182,000 acres (73,754 ha) of the refuge lands have been selected but are still under federal jurisdiction; these lands may or may not be interim conveyed. Table 1 indicates the status of land within the refuge boundary as of July, 1985; Figure 5 shows the locations of the selected and interim conveyed lands. Appendix G lists the Native village selections and interim conveyances in more detail.

Koniag, Inc., the Native regional corporation, has selected lands in the refuge under Section 14(h)(1) of ANCSA. They have submitted 18 applications for cemetery/historical sites, totaling 19,422 acres (7,860 ha) under Section 14(h)(1). All lands conveyed under ANCSA within the original Kodiak Refuge established in August 1941 remain subject to Section 22(g) of ANCSA--refuge lands conveyed to the village corporations remain subject to the laws and regulations governing use and development of the refuge.

There are about 1,400 acres (570 ha) of private patented inholding within the refuge boundary. This includes:

- 71 homestead sites totaling 945 acres (382 ha)
- 2 homesites totaling 11 acres (4 ha)
- 3 trade and manufacturing sites totaling 26 acres (11 ha)
- 3 mission sites totaling 12 acres (5 ha)
- 1 Native townsite of Akhiok totaling 93 acres (38 ha)
- 2 headquarters sites totaling 323 acres (130 ha)

PHYSICAL ENVIRONMENT

Area of Influence

Kodiak Island is one of a group of islands that lie at the western border of the Alaska Gulf between 56`30' and 58`40' north latitude and 150`40' and 154`50' west longitude. The Kodiak archipelago extends 177 miles (285 km) in length by 67 miles (108 km) in width to encompass about 5,000 square miles (13,000 m^2). The refuge interior lands and waters are linked to the Pacific Ocean by several rivers.

Table 1. Land status of Kodiak Refuge as of July, 1985.[a]

Ownership	Acres	% of Refuge
Federal	1,380,000	74
Native Village Corporation and groups		
-Selections[b]	182,000	10
-Conveyances[c]	271,900	15
Regional Corporation		
-14(h)(1) Selections[d]	19,000	1
-14(h)(1) Conveyances	0	0
Native Allotments		
-Applications[e]	10,000	<1
-Conveyances	300	<1
Private Parties[f]		
-Selections	0	0
-Conveyances	1,400 (patented)	<1
Total	1,865,000	100

[a] Acreages are approximate due to rounding, inaccuracies in information available, and changes in the land status (e.g., relinquishments, invalidations and conveyances of selected lands). For a more detailed description of the Native village corporation entitlements, see Appendix G.

[b] The Native village corporations have overselected on Kodiak Refuge. Consequently, some of these selections will be invalidated. All of the selected lands are under federal jurisdiction until the lands are interim conveyed.

[c] Conveyances include interim conveyances, patented lands, and lands legislatively approved for conveyance.

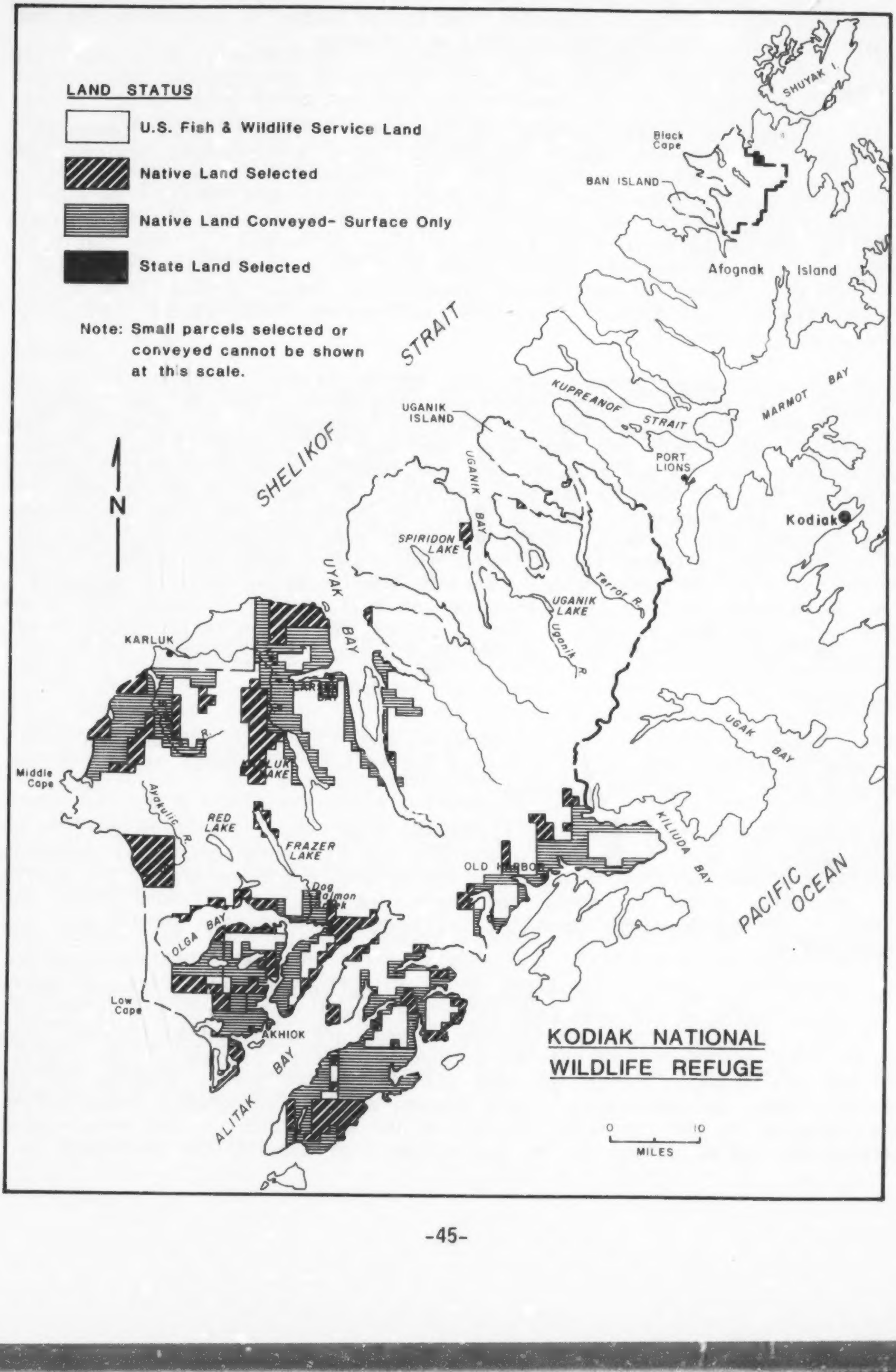
[d] Section 14(h)(1) selections are historic/cemetery sites that have been identified by the regional corporation, Koniag, Inc. in this case. The selected lands are under federal jurisdiction until the lands are interim conveyed.

[e] The Native allotment application lands remain under federal jurisdiction until they are interim conveyed to the Natives.

[f] Private inholdings include homestead sites, trade and manufacturing sites, mission sites, Native townsites, and headquarter sites.

Source: Reality Division, U.S. Fish and Wildlife Service, Anchorage, AK.

Figure 5. Land status of Kodiak Refuge


LAND STATUS
U.S. Fish & Wildlife Service Land
Native Land Selected
Native Land Conveyed- Surface Only
State Land Selected
Note: Small parcels selected or conveyed cannot be shown at this scale.
N
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
Terror R.
UGANIK LAKE
Uganik R.
KARLUK
R.
KARLUK LAKE
Middle Cape
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
UGAK BAY
KILIUDA BAY
OLD HARBOR
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

The refuge's area of influence encompasses the entire archipelago, including the city of Kodiak and seven island villages. The northern portion of the Alaska Peninsula, although separated from Kodiak Island by the narrow Shelikof Strait, is also within the refuge's area of influence.

Climate

Kodiak Refuge is wholly within the maritime climatic zone: temperature variations are generally small (except in higher elevations); humidity and precipitation are high; fog and clouds are frequent; and freezing weather is rare. The overall mean annual temperature is about 40`F (4`C). Because of the warming effect of the Alaska Current (a northern eddy of the Japanese Current) the climate is more temperate than is normal for the latitude. Summer air temperatures are seldom above 75`F (24`C) and winter rarely below 0`F (-18`C). Periods of subfreezing temperatures regularly occur from October through April; at higher elevations subfreezing temperatures can occur throughout the year.

Moist air is always present over the Kodiak Islands, brought in by the Aleutian low in the winter and the continental low in the summer--precipitation occurs year-round. Rain is generally light, but of long duration. More than 100 wet days (on which 0.1 inch (2 mm) or more precipitation occurs) are expected per year, whereas most of Alaska, including Anchorage, has less than 50 wet days per year. At Kodiak the driest times are late winter and midsummer, but even then the probability of a wet day remains high (Johnson and Hartman, 1969). Average precipitation at Kodiak is 62 inches (157 cm), although the southeast sides, being open to the Pacific, are wetter than the northwest side. Maximum precipitation, falling around the high peaks above Kiliuda Bay (Karlstrom and Ball, 1969), is about 115 inches (292 cm), five times as much as the 23 inches (58 cm) on the Shelikof Strait side at Karluk River and Larsen Bay (Jones and others, 1978).

Landforms

Kodiak Island is 100 miles long by 60 miles wide (160 km by 100 km) and covers an area of about 3,600 square miles (9,300 km^2). This makes it one of the largest islands in the United States.

The refuge has a rugged 800-mile (1,300-km) coastline. The north portion of the island is very rocky and irregular, and is characterized by numerous glacially-scoured straits, inlets, and fjords with branching arms. Sea bluffs are generally steep and rocky and there are numerous offshore rocks and islets. The southwestern coastline is, however, relatively smooth with few indentations.

The Kodiak Islands are intensely scoured and eroded by at least three glaciations bringing ice down Cook Inlet and across Shelikof Strait as well as from local sources. Accordingly, the islands are entirely mountainous from interior to shoreline, the only exceptions being flat bottoms of the glacial valleys and moderate relief on some glacial deposit aprons forming lowland shores, capes, and peninsulas. More subdued mountain topography characterizes the refugium in the southwest (Karlstrom and Ball, 1969). The most rugged terrain on Kodiak Island is in the refuge from Cape Alitak northeast to

Kizhuyak Bay. The highest peaks here, including Koniag Peak and Mount Glottof, are over 4,000 feet (1,200 m) high. On Afognak Island refuge lands, some ten individual glacial horns reach elevations over 2,000 feet (600 m).

Drainages flow predominately northwest and southeast, following valleys deepened and straightened by glacial ice. The straits and elongate bays are fjords, representing former valleys over-deepened by ice to below present sea level. The refuge's many elongate lakes occupy ice-scoured trenches, dammed by moraines. Except for the Ayakulik/Red and Karluk rivers, which drain large glacial lakes, the island's rivers are small, short and steep. They flow in valleys straightened by glaciers and end quickly in bays. The island's bays are indented to such an extent that no place on the island is more than 15 miles (24 km) from the sea. Valleys are generally steep-walled, U-shaped, with hanging tributaries. V-shaped and terraced canyons may be found where moraines have been breached or in areas where stream piracy or lateral diversion has occurred (as is common in a glacial landscape).

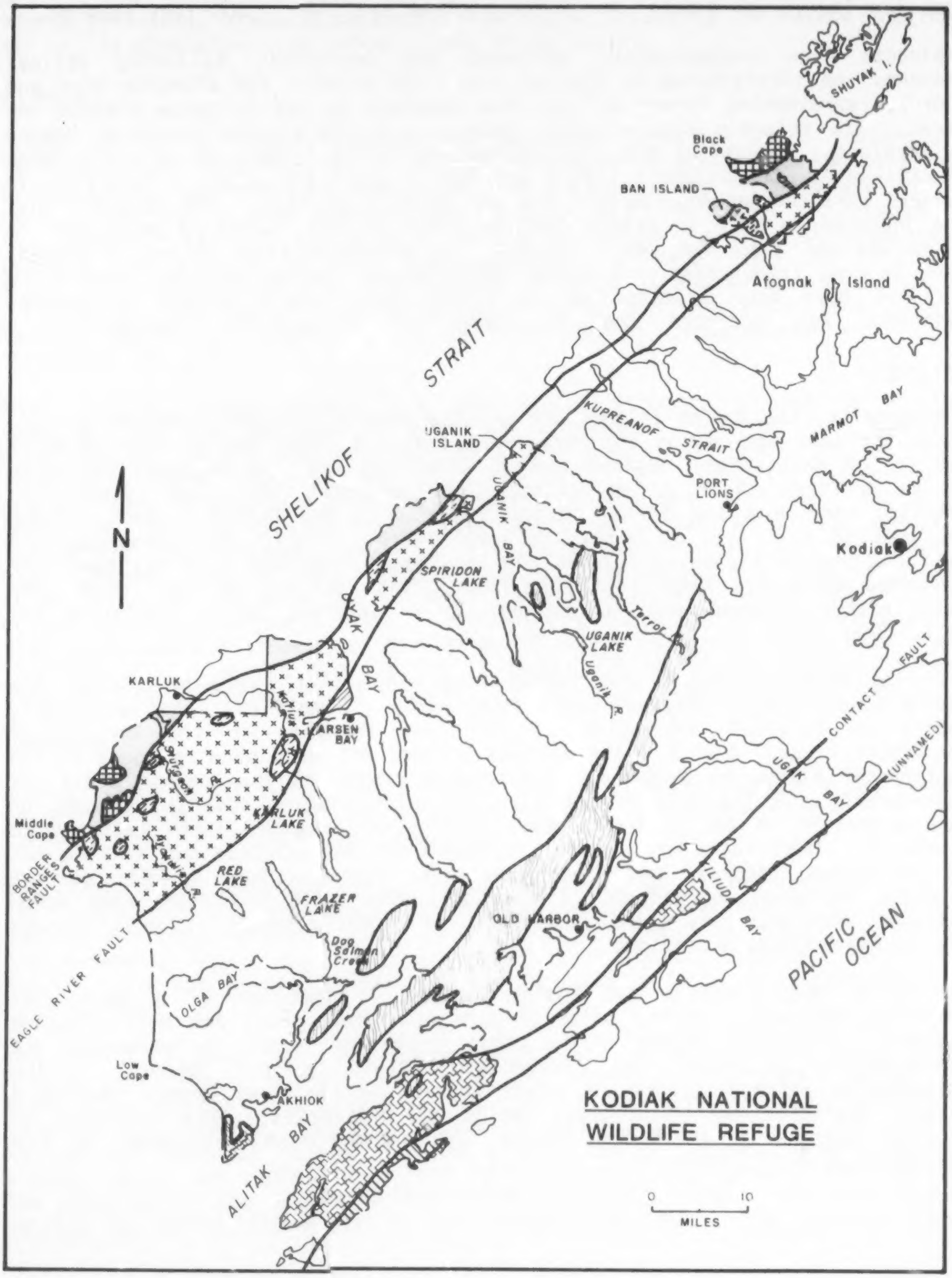
Geology

Geologically, the Kodiak Islands are an appendage of the Kenai Peninsula; they share the same rock types and structures, and are separated by only 40 miles (60 km) of salt water. Before glacial times the two were probably connected by an unbroken chain of mountains, then separated when Cook Inlet ice, spilling through a low divide in the vicinity of the Barren Islands, eroded the rock in that area to below sea level (Capps, 1937). Karlstrom suggests that the preglacial Kodiak Islands and the Alaska Peninsula also may have been connected above sea level, with Shelikof Strait like all of Cook Inlet then being either a broad alluvial valley, or an interior basin (Karlstrom and Ball, 1969).

Like the Kenai Peninsula and indeed like many other parts of Alaska, the Kodiak Islands are "accreted" continental parts. Simply put, they are mostly wedges of original mud collected in ocean trenches at the margins of convergent crustal plates. The mud was scraped off onto bending edges of the continental plate, or subducted with oceanic crust, as the oceanic plate was underthrust. Kodiak Island rocks are in belts showing several episodes of such accretion in the geologic past, successively younger from northwest to southeast. Most rocks are shales, representing the original mud settled out in the ocean trenches, and also graywackes, representing turbidity current deposits including coarser rock fragments. Other rocks represent deep ocean siliceous ooze and clay mixed with blocks of subcrust brought upwards against the downward-moving accretions.

The solid rock founding the Kodiak Islands is composed of a series of southwest-northeast trending belts (Figure 6). Rock types are mostly marine sediment, originally deposited in ocean basin and slope environments, but subsequently "deformed" and "metamorphosed" in various degrees. The metamorphism where occurring in lesser degrees or shallower depths imposed a "slaty" character on the original shales and graywackes; where occurring in greater degree in subduction zones the metamorphism proceeded to the generation of schist rock.

Figure 6. Bedrock geology of Kodiak Refuge.


SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
N
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
Terror R.
UGANIK LAKE
Uganik R.
KARLUK
LARSEN BAY
Karluk R.
Sturgeon R.
KARLUK LAKE
Middle Cape
BORDER RANGES FAULT
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
CONTACT FAULT
UGAK BAY
(UNNAMED)
KILIUD BAY
PACIFIC OCEAN
EAGLE RIVER FAULT
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Legend for Figure 6.

SEDIMENTARY ROCKS

◯	Oligocene	Sitkinak Formation Slope volcaniclastic turbidites and delta fan deposits; represents, with the Sitkalidak formation (and Narrow Cape Formation), progradational deposition in an inactive trench.
◌	Eocene and Oligocene	Sitkalidak Formation Deep sea volcaniclastic abyssal plain deposits and outer fan turbidites; interbedded sandstone and shale.

(bounding fault: unnamed, high-angle fault)

▩	Paleocene and Eocene	Ghost Rocks Formation Syndepositionally deformed hemipelagic argillite and turbidite graywacke interbedded with pillow basalt; tectonically bound, melange-like locally, may represent a subducting trench, may otherwise be a rafted exotic fragment.

(bounding fault: Contact Fault, major through-going high-angle fault)

◯	Late Cretaceous	Kodiak Formation Marine turbidite trench-floor sequence, medium to thickly bedded arkosic graywacke and shale with occasional beds of pebbly conglomerate; sole markings and graded bedding; generally deformed into tight folds and locally broken; correlative with the Valdez Group; represents, with the Uyak Complex, a bi-phasal latest Mesozoic accretion.

(bounding fault: Eagle River Fault, major through-going thrust fault)

⊗	Late Cretaceous	Uyak Complex
▨	(Ultramafic bodies)	Chaotic melange of deep sea sediments and igneous rocks; mostly argillite and gray chert, thinly layered and highly deformed, plus internally sheared graywacke and minor green tuff; contains slabs of gabbroic and ultramafic rocks; correlative with McHugh Complex; represents with the Kodiak Formation a bi-phasal latest Mesozoic accretion.

(bounding fault: Border Ranges Fault (inferred), major through-going high-angle fault)

◬	Early Jurassic	Kodiak Schist Thinly layered and complexly folded quartz-mica schist, blue schist-bearing, with green schist and epidote amphibolite; accretionary unit, represents vestige of earliest-known subduction complex; correlative with the Seldovia Schist.

(bounding fault: unnamed, not exposed, inferred, intruded by the Afognak Pluton)

▦	Late Triassic	Shuyak Formation Well-bedded little-deformed volcaniclastic turbidite sediments from coeval volcanism along the site of the Alaska-Aleutian Range Batholith, plus a pillowed greenstone volcanic member; represent the seaward remnant of a fore arc basin presently thrust over the Kodiak Schist but separated from it by the Afognak Pluton.

INTRUSIVE ROCKS

▥	Paleocene	Kodiak Batholith Biotite-quartz monzonite, fine-grained
◯	Early Jurassic	Afognak Pluton hornblende-quartz diorite, with local migmatite and aplitic dikes along contacts with the Kodiak Schist and Shuyak Formation.

Source: map locations from Fisher and von Huene, 1982; descriptions from Connelly and Moore, 1979, and Connelly, 1976)

The oldest rocks in the Kodiak Islands are exposed along the northwestern island margins and represent the earliest known "subduction" event, in late Triassic-early Jurassic times. The rock types are blueschist-bearing quartz-mica schist (the Kodiak Schist), and volcaniclastic basin sediments with "pillowed" lava (the Shuyak Formation). The Kodiak Schist crops out in the Afognak Island sector of the refuge, through the middle of Ban Island, and southwest of Hidden Lake. Shuyak Formation rocks are exposed on Afognak Island, northeast and southwest of Devil Inlet, and on southwest Kodiak Island of Middle Cape, and between Cape Grant and Grant Lagoon.

The next oldest rocks in the Kodiak region are adjacent to the southeast and in fault contact with, in various places, either the Shuyak Formation, Afognak Pluton, or Kodiak Schist. These formations represent a second subduction event, probably in the late Cretaceous-early Tertiary as this was the second period of extensive igneous activity in the Alaska-Aleutian Range. The late Cretaceous-Paleocene rocks are the most abundant on the islands, and consist of the Uyak Complex, the Kodiak Formation, and the Kodiak Batholith. The Uyak Complex forms a northwest border strip, cropping out on Kodiak Island through the Bumble Bay-Larson Bay-Saddle Mountain region, and on the Afognak Island refuge sector south of Red Peak. Throughout the complex, fossils range from middle Permian to mid-lower Cretaceous.

The Kodiak Formation in the late Cretaceous-Paleocene terrain is southeast of the Uyak Complex, and represents the second of a two-phase subduction/accretion (Connelly, 1976). Kodiak Formation rocks are black shales and graywackes, with sedimentary structures indicating original deposition in a trench, similar to the present-day Aleutian Trench (Winkler, 1979). These rocks comprise the widest belt of any single rock type in the islands and occupy more than half of the refuge.

Igneous rock is the third kind associated with the late Cretaceous-Paleocene subduction/accretion, cropping out through the Kodiak Island sector of the refuge from Tanner Head northeastward to Terror Lake, forming headlands, peninsula ridges, and the mountainous axial crest of the island. The rock is a biotite-quartz monzonite, having a whitish background of quartz and white feldspar and flecked with darker minerals. Many smaller satellitic masses, dikes and sills of similar rock, and abundant quartz veining in places where no intrusive rocks are exposed all indicate the rock is more extensive than its outcrop and occupies larger areas underneath the surface.

All these rocks form most of the Kodiak-Kenai-Chugach Mountains and are accordingly the best exposed in the region, generally all black-colored slaty-textured shales and graywackes, fault-bounded southeast by the Contact Fault and northwest by the Eagle River Fault.

A third crustal event in the Kodiak Islands is represented by another tectonically bound rock assemblage called the Ghost Rocks Formation, on the refuge north of Sitkalidak Bay and on the Aliulik Peninsula. Like the Kodiak Formation and McHugh Complex, the assemblage includes deep-sea argillite, pillow basalt, and turbidite sediments, folded, faulted, and sheared, and locally melange-like. The Ghost Rocks Formation may, therefore, represent a third subduction event, perhaps in Eocene times; alternatively, it may be an "exotic" crustal fragment drifted from afar (Neilsen and Moore, 1979).

The youngest bedrocks on Kodiak Refuge occupy a small area along the southeast margin of the Aliulik Peninsula and belong to the Eocene and Oligocene Sitkalidak and Sitkinak Formation. The rocks are again deep-sea sediments, but little deformed, having been deposited in an inactive trench; they may, however, be folded and faulted at depth, showing compressional effects like those suggested for sediments further southeast subjected to the Pliocene to present-day Aleutian Trench subduction (von Huene, Moore, and Moore, 1979).

Surficial Deposits and Glacial Geology

Three main glaciations are known in the Kodiak Islands; from oldest to youngest they are: the Sturgeon River, Karluk, and Akalura (Table 2). Figure 7 shows the maximum extent of the Karluk and Akalura glacial advances. During each event ice completely covered the islands, except for the refugium in southwest Kodiak Island, and continued seaward some 50 miles (80 km) beyond. All the continental shelf was covered and amended by glacial debris; presently the shelf edge is marked by submarine moraine. Kodiak Island was probably a local center of ice accumulation, around and along the flanks of which glaciers from the Cook Inlet, Alaska Peninsula, and Kenai Peninsula flowed (Capps, 1937).

A central mountainous tract in southwest Kodiak Island with topography more rounded and subdued than the rest of the islands is surrounded by moraines of the last two glaciations (Karlstrom and Ball, 1969). The tract has thus apparently been left uneroded by ice that dates from times of these moraine depositions. An outermost perimeter of moraines passes across and between sections northwest of Olga Bay, Frazer Lake, and Karluk Lake, and across lower portions of river drainages along the coast. An inner perimeter crosses higher reaches of the valleys and confines a somewhat smaller interior region of the tract left uncovered by ice since the Sturgeon River Glaciation. Since last cut and sculptured by Sturgeon River ice, this interior region has been subject to weathering for about 100,000 years, or some ten times longer than the rest of the Kodiak Islands.

Karlstrom and others (Karlstrom and Ball, 1969) investigated the southwestern part of the refuge as a possible biological refugium, but insufficient sampling and unknown significance of organisms apparently prevented more than a conjecture about possible survival of biota during severe climates induced by surrounding glacial ice.

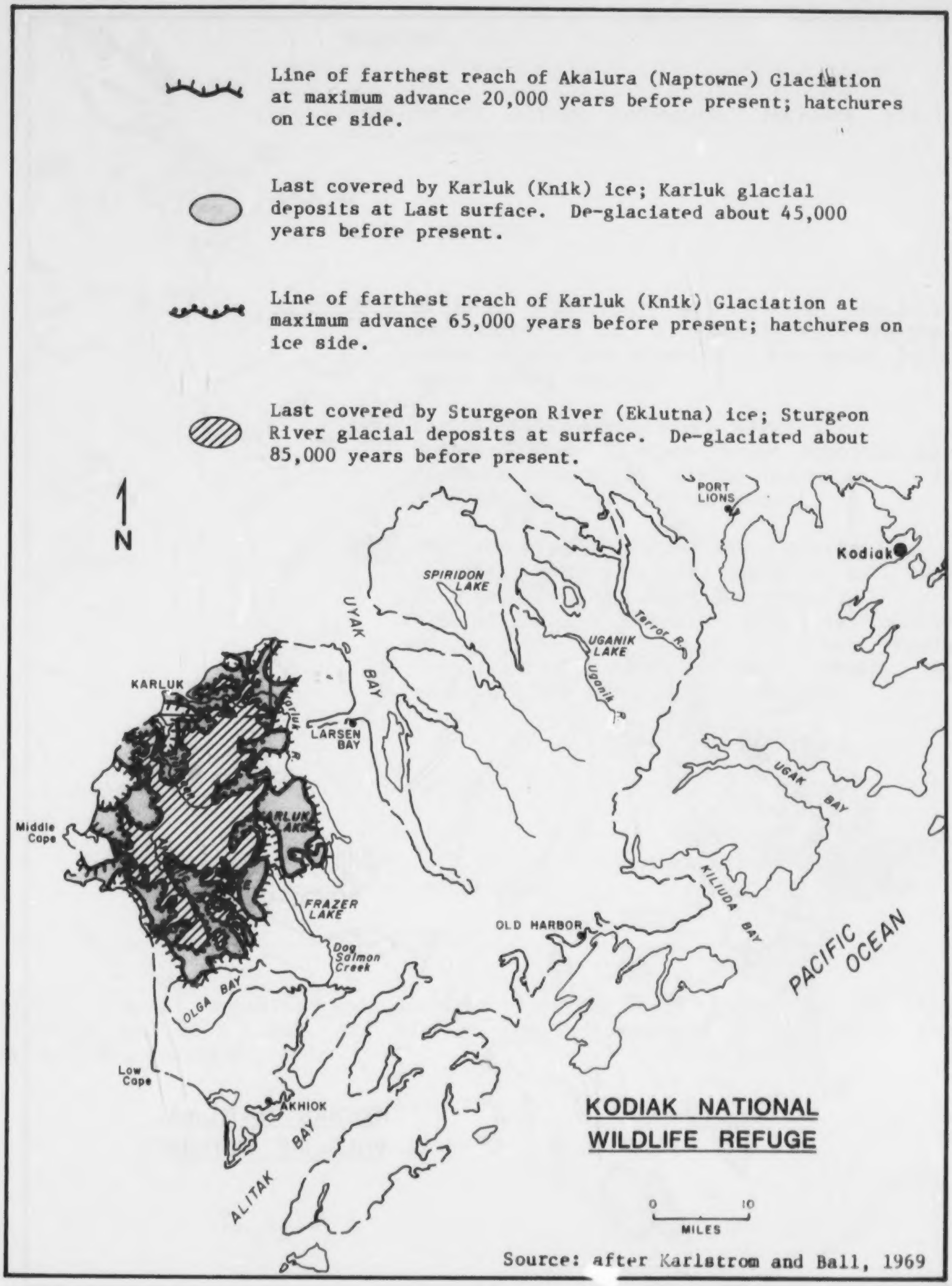
Excepting volcanic ash, unconsolidated deposits are not continuous or thick on the Kodiak Islands. Figure 7 shows areas of thicker glacial till deposits, and river alluvium and glacial outwash. Local accumulations of alluvium are also present along the bottom of bedrock slopes. The glacial till, deposited during glacial advancement, is mostly clay material. The thickest deposits are in the valley lowlands, indicated by luxuriant grass cover below elevations of 1,000 feet (1,600 m); thin sheets of clay and scattered remnant boulders are on higher slopes. Lower parts of valleys have more gravel deposits where terminal moraines are present, indicating temporary standstills during glacial retreat. Terminal moraines are most evident where they now dam lakes and embay shorelines. Outwash, consisting of glacial till deposited by melt water during glacial withdrawal, is deepest in the valleys, resting on or incorporated with till. Outwash also occurs in aprons across lowland areas, notably across the southwestern coast of Kodiak Island.

Table 2. Pleistocene glaciations and interglacial periods on the Kodiak Islands.

Glaciation or Interglacial Period	Age, Years Before Present	Cook Inlet or North American Correlations	Remarks About Possible Land Refugial Areas
Akalura Glaciation	20,000	Naptowne	Austere glacial climate. A possible refugial area, includes some valley bottomland and clear water streams around Boundary Creek, lower Karluk River, and Ayakulik/Red and Sturgeon drainages.
Woronzofian Interglacial	45,000	Port Talbot	Warm climate. Probable dispersal of surviving biota from refuge, invasion of forms from outside.
Karluk Glaciation	65,000	Knik	Austere glacial climate. Refugial area limited to middle and alpine slopes. Climate and silty lakes probably eliminated even subalpine species; survival of only the hardiest, on upper tundra slopes and crest lines.
Pelukian Interglacial	85,000	Sangamon	Warm climate, probable invasions.
Sturgeon River Glaciation	110,000	Eklutna	Glacial ice covered all Kodiak Island except isolated nunataks.

Source: Karlstrom and Ball, 1969.

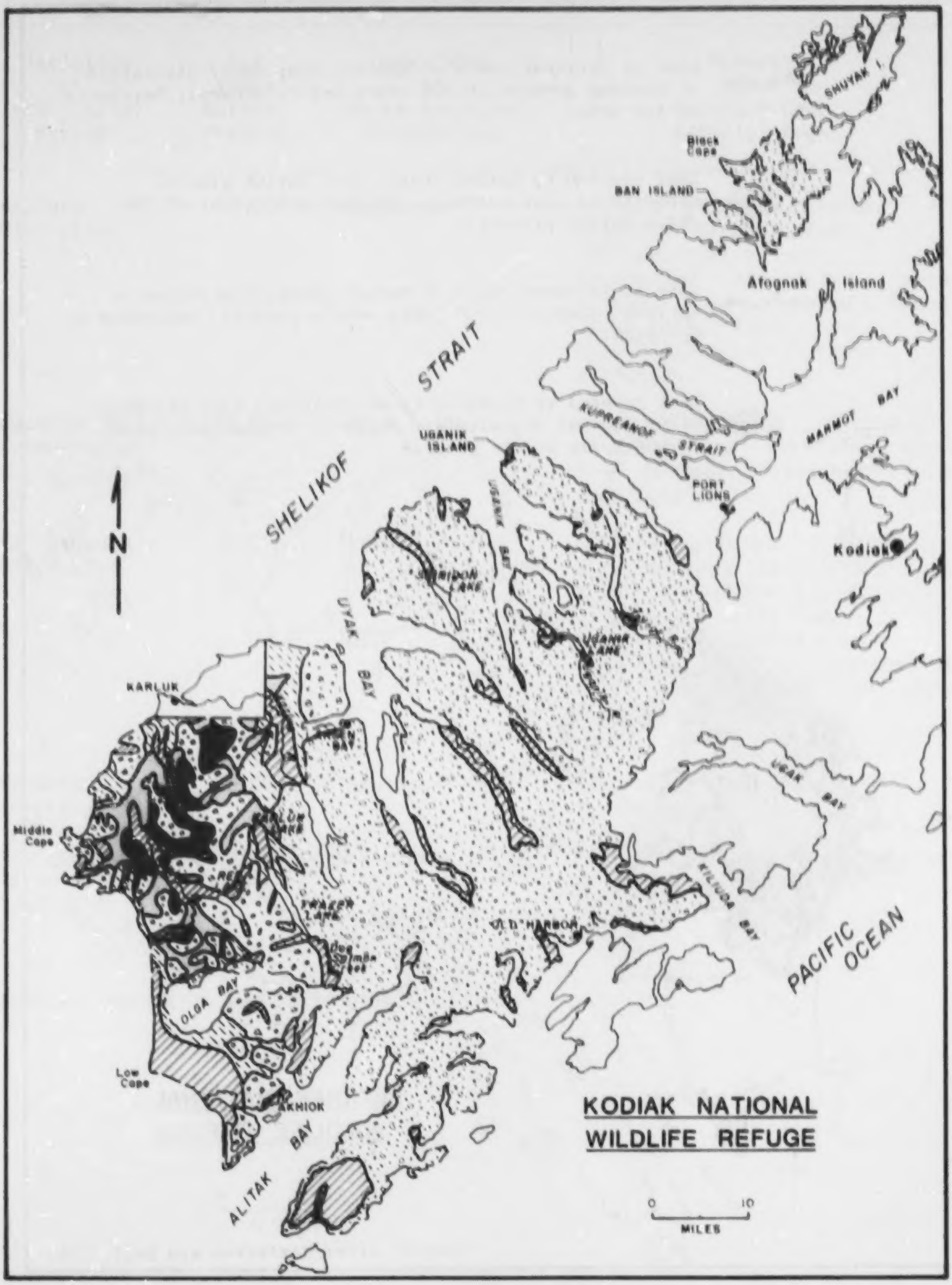
Figure 7. Maximum extent of the Karluk and Akalura glacial advances.


Line of farthest reach of Akalura (Naptowne) Glaciation at maximum advance 20,000 years before present; hatchures on ice side.
Last covered by Karluk (Knik) ice; Karluk glacial deposits at Last surface. De-glaciated about 45,000 years before present.
Line of farthest reach of Karluk (Knik) Glaciation at maximum advance 65,000 years before present; hatchures on ice side.
Last covered by Sturgeon River (Eklutna) ice; Sturgeon River glacial deposits at surface. De-glaciated about 85,000 years before present.
N
PORT LIONS
Kodiak
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Uganik R.
Terror R.
KARLUK
Karluk R.
LARSEN BAY
UGAK BAY
Middle Cape
KARLUK LAKE
FRAZER LAKE
OLD HARBOR
KILIUDA BAY
PACIFIC OCEAN
Dog Salmon Creek
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Source: after Karlstrom and Ball, 1969

READEX FICHE

Figure 8. Surficial deposits of the Kodiak Refuge area.


SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
UGANIK BAY
PORT LIONS
Kodiak
N
SPIRIDON LAKE
UGANIK LAKE
UYAK BAY
KARLUK
KARLUK LAKE
Middle Cape
FRAZER LAKE
OLD HARBOR
OLGA BAY
UGAK BAY
KILIUDA BAY
PACIFIC OCEAN
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Legend for Figure 8.

ALLUVIUM

▨ recent stream sediments, includes glacial outwash in places.

GLACIAL DEPOSITS

░ Akalura (Naptowne) age glacial deposits; boundaries on Karluk deposits mark farthest reach of Akalura advances. Age about 20,000 years before present.

▒ Karluk (Knik) age glacial deposits. Boundaries on Sturgeon River deposits mark farthest reach of Karluk advances. Age about 60,000 years before present.

■ Sturgeon River (Eklutna) age glacial deposits; may include deposits of older (Caribou Hills and Mount Susitna) glaciations. Deposit area approximates valley-floor portion of so-called "Kodiak Refugium" (Karlstrom and Ball, 1969). Age about 110,000 years before present.

BEDROCK

░ Jurassic to Oligocene, mainly shale, slate, and granite.

Source: glacial deposits and alluvium inferred from topography and from Karlstrom and Ball, 1969, and Plafker and Kachadoorian, 1966; bedrock from Moore, 1967, and Capps, 1937

The modern streams have entrenched glacial deposits in places, but the comparative volume of river alluvium is small because rivers are short and steep.

Volcanic ash comprises most of the continuous unconsolidated deposits, as is reflected by the nature of all Kodiak soils. In particular, the 1912 ash fall from Mount Katmai remains in many places through an east-west belt across a central part of the islands about one foot thick below vegetative cover (Capps, 1937; Plafker and Kachadoorian, 1966). Volcanic ash is also probably the largest contributor to delta building at the heads of bays receiving moderately large streams.

Soils

All the soils on Kodiak Refuge are formed from or over volcanic ash. Locations and descriptions of the soil associations are shown in Figure 9. The units shown are "associations," each designated for one or more particular areas or "landscapes" containing consistent soil patterns as related by landform and vegetation. The association names include one or more of the

The Red River in the Kodiak Refugium.

extensive soils. Individual soils are "subgroups". In Figure 9, the percentages given for each subgroup are relative extents not necessarily on the refuge but throughout an association (throughout the area so designated).

Among the subgroups comprising the three associations represented on the refuge, about 75% are dystric cryandepts, and 15% are fluvaquentic cryofibrists, with the remaining 10% being bare rock. Cryandepts are cold-temperature soils that have formed in volcanic ash, so they are to some degree thixotropic (exhibit fluidity under stress). Fluvaquentic cryofibrists are mostly undecomposed, unfrozen organic matter.

Mineral Occurrences

The Kodiak Islands have not been adequately explored to form a complete picture of the areas mineral potential. Presently, no economically valuable mineral deposits are known. It should be noted that all refuge lands are closed to mineral entry.

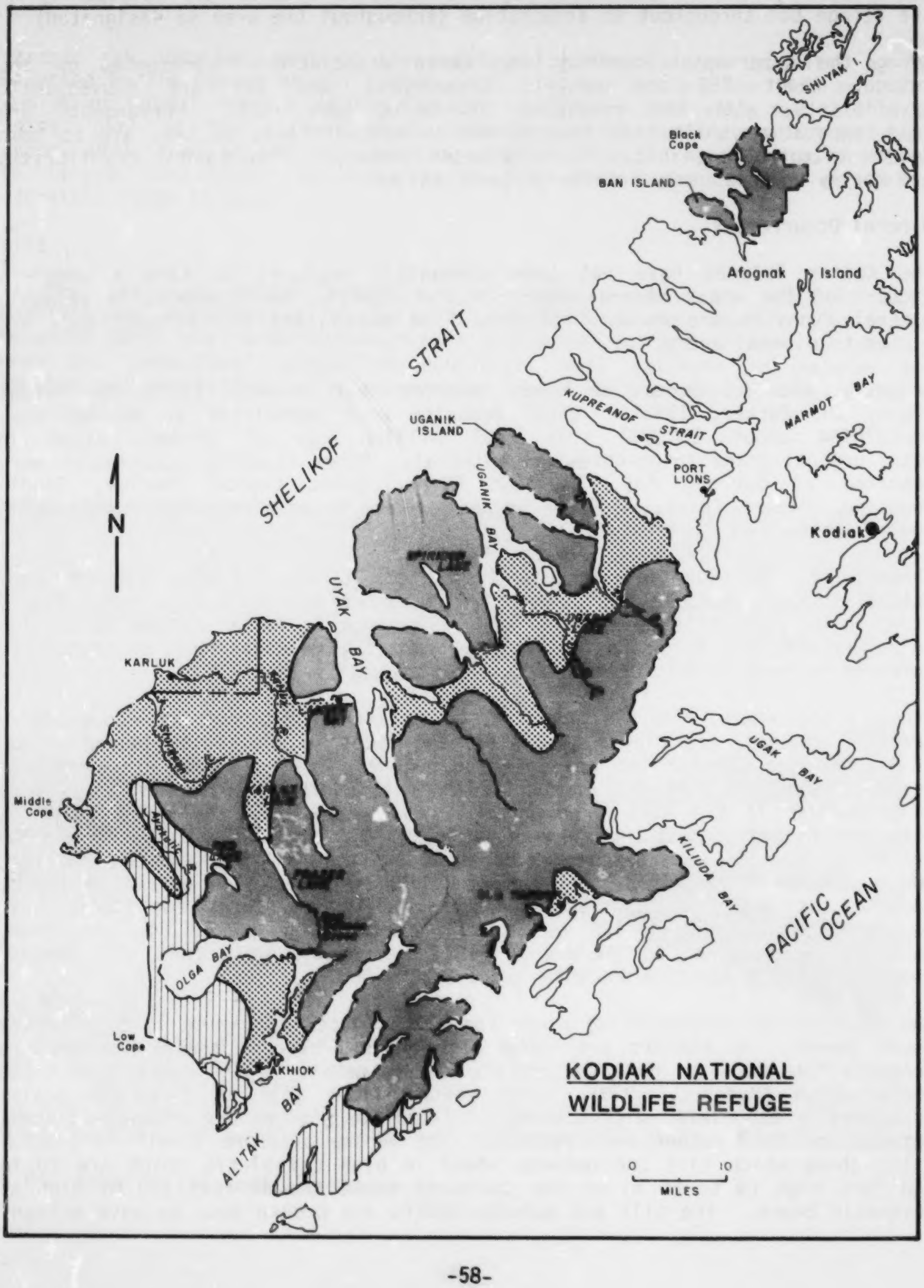
Recently, the U.S Bureau of Mines reported that chromite is in the refuge (Foley and Barker, 1985). Eight deposits were identified at Halibut Bay, containing about 200,000 tons (182 million kg) of chromic oxide in metallurgical-grade (high-chromium) material. Other chromite occurrences were reported at Guerney Bay, Sturgeon River, Grant Lagoon, Karluk, Saddle Mountain, Miners Point, and Ban Island. The chromite occurs in ultramafic bodies in the Uyak Complex.

Chromite is an essential ingredient in tool steel. Chrome deposits are actively sought because most chrome is imported into the U.S. No clearly economic U.S. deposits have been found. The rock in Kodiak Refuge is too low in value per ton to economically mine, but the deposits are an identified inferred reserve of this critical strategic commodity.

Other sites where minerals are reported present, but not in economically feasible amounts, are placer gold sites and lodes in the Kodiak Island sector of the refuge; all but two are on ocean beaches, and the lodes are in quartz veins (Table 3). All were prospected beginning perhaps 100 years ago and up to World War I; the last known activity was around 1935 after the price of gold was raised. Most of the mining took place in the early 1900's. The "richest" deposits were placers, with the best known sites on the southwestern coast (between Cape Alitak and the Ayakulik/Red River), on Sevenmile Beach, and on the west side of Uganik Island. Martin (1913) estimated their aggregate production at $20 per ounce was as much as $10,000 per year, accumulating to $150,000 (Maddren, 1919). Converted to present day prices, the cumulative production would be about $4,000,000.

The eroding and concentrating power for beach placer formation is supplied by ocean waves. No placers are known along rivers because Kodiak streams are probably too small to have concentrated heavy metals in the short time since deglaciation (Maddren, 1919). The beach placer gold is fine and scaly, occasionally associated with platinum. Immediate sources are probably glacial outwash and till rather then bedrock. The marine platform itself is glacial till, above which till and outwash stand in high sea bluffs which are 20 to 250 feet high (6 to 80 m) on the southwest coast and 60 feet (20 m) high at Sevenmile Beach. The till and outwash bluffs are broken down by wave action

Figure 9. Soil associations of Kodiak Refuge.


SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
UGANIK BAY
PORT LIONS
Kodiak
N
UYAK BAY
KARLUK
UGAK BAY
Middle Cape
KILIUDA BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Legend for Figure 9.[a]

▥ Dystric Cryandepts - Fluvaquentic Cryofibrists on nearly level plains of southern Kodiak Island; formed from volcanic ash overlying gravelly alluvium:

- o Dystric Cryandepts (70 percent) - well-drained; consist of more than 30 inches of thixotropic dark reddish brown to black volcanic ash.
- o Fluvaquentic Cryofibrists (30 percent) - constantly wet, in depressions; consist of dark brown fibrous sedge peat over 60 inches thick, with common ash partings.

▒ Dystric Cryandepts over footslopes and steep hills; formed from volanic ash overlying glacial till:

- o Dystric Cryandepts (80 percent) - well-drained; consists of more than 30 inches of thixotropic volcanic ash, with an upper black and a lower dark reddish brown horizon, commonly overlain by as much as 12 inches of fresh volcanic ash.
- o Fluvaquentic Cryofibrists (10 percent) - wet, in depressions; consists of more than 60 inches of dark brown sedge peat with seams of ash.

░ Dystric Cryandepts on mountain footslopes and steep hills; formed from volcanic ash overlying gravelly glacial till or bedrock:

- o Dystric Cryandepts (40 percent) - well drained, on lower mountain slopes; consists of 16 to 40 inches of thixotropic dark brown to dark reddish brown volcanic ash, commonly overlain by as much as 12 inches of fresh ash.
- o Dystric Lithic Cryandepts (30 percent) - well drained, on middle slopes of mountains; consists of 10 to 20 inches of thixotropic dark brown to dark reddish brown volcanic ash.
- o Rough Mountain Land (30 percent) - bare rock and rubble, on ridges and peaks.

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[a] The soil association names are those of the one or two most representative individual soils. The percentages indicate relative extent of individual member soils.

Source: Rieger and others, 1979.

Table 3. Sites of past mineral activity on Kodiak Refuge.[a]

Name	Type	Remarks
Cape Alitak	beach placer	Reported past production; includes supposed wind-blown gold concentrates in dune sand (Capps, 1937)
Kodiak Island West Coast	beach placers	Probable but unreported individual production
Ayakulik River	coal detritus	Probably float coal in fossil beach deposit
Sevenmile Beach	beach placer	Reported past production
Callaveras	lode	Accessory lead and arsenic; reported minor production
Amok	lode	500 feet of working and stamp mills represent only underground mining; production worth $8,000 in early 1900's
Lake	lode	
Wanberg & Boyer	lode	
Cape Kulik	beach placer	Production unknown
Cape Ugat	beach placer	Production unknown
Miners Point Beach	beach placer	Reported past production
Uganik Beach	beach placer	Reported past production
Blue Boy 1-2	lode	
Moyle	lode	Three short adits, but no production
Sonny Jim	lode	
Bauman & Strickler	lode	Underground workings and stamp mill, but no production reported
Apex Group	lode	
Tarn	lode	Tungsten in quartz veins in graywacke
Barling Bay	lode	Production unknown

[a] All mining was for gold, except where noted.

Source: U.S. Bureau of Mines, mineral deposit location records, Juneau, AK.

of surf and storm, especially from the the southwest and northwest during spring and autumn when the tidal range is greatest. "Summer swell" waves were effective at creating placer formations, formed by the "washing down" of eroded till across the marine platform, and "banking up" of a 4 to 6 foot (1 to 2 m) overburden of barren sand by surf. Although gold has been reported along most of the sea bluff beaches, placer concentrations were local patches; each patch was considered the result of a single storm (Maddren, 1919). The 1912 earthquakes associated with the Mount Kamai eruptions broke down previously smooth shorelines, leaving eroding cliffs that led to successful placer mining in the following years.

About half of the sites with reported minerals are lodes; available records indicate that actual mining was done at four sites. Two, the Amok and Callaveras, reported production. The Amok lode was the most important: in 1913, it produced a few hundred tons of ore, then worked unsuccessfully from 1926-1927.

The gold in the beach placers indicates a source of metal in bedrock, but no sizeable veins or lodes are reported where metal is sufficiently concentrated for economic purposes. When seen, most veins are narrow, with some occupying shear zones. Larger veins, however, may be present beneath the surface of intrusive rock along the western side of the islands and across the central axis of Kodiak Island. The most favorable sites are near the known lodes around Uyak and Spiridon bays, and in the bedrock which provided the southwest coast placer sites (Arctic Environmental Information and Data Center, 1983).

Coal occurs on Sitkinak Island in beds of 10 to 12 feet (3 to 4 m) thick (Maddren, 1919), and also on Sitkalidak Island (Nilsen and Moore, 1929), but the only occurrence on the refuge is some alluvial coal in a fossil beach deposit above the beach near the Ayakulik River (Martin, 1913).

Oil and Gas

The Kodiak Islands onshore bedrocks are about 90% Mesozoic, with no petroleum potential, and 10% Tertiary, with very slight potential in certain sections. All the Mesozoic rocks, and the Paleocene rocks (Ghost Rocks Formation), are deformed, indurated (i.e., hardened by heat, pressure or cementing material), and lack porosity. Some Eocene and lower Oligocene rocks (Sitkalidak Formation) have sandstones, but these are likely unsorted or cemented and thus have only slight oil and gas potential. Middle Oligocene to lower Miocene rocks (Sitkinak and Narrow Cape Formations) have better reservoir characteristics, but they occur only in a narrow fringe at points along Kodiak Island's southeast shore. These rocks, being close to the fault zone, also may be deformed at depth

Offshore, in middle and upper Tertiary rocks, petroleum prospects are favorable along the southeast side of Shelikof Strait (Magoon et. al., 1979) and along the Kodiak Shelf (Ehm, 1983; von Huene et. al., 1971; Plafker, 1971). The present Kodiak shelf edge appears to coincide with an arch, which may have formed to allow basin deposition of upper Tertiary sediments behind it (landward). Southeast of Kodiak Island the upper Tertiary section is about 13,000 feet (4,000 m) thick. Below this, lower and middle Tertiary rocks may contain hydrocarbon source beds as at Yakataga and other districts in the Gulf of Alaska. Favorable structures are likely in the arch, which is about 50 feet (15 m) deep and 70 miles (110 km) long over Albatross Bank. In the Shelikof Strait, the southeast side has Tertiary rocks that overlie middle Jurassic rocks--the hydrocarbon source of the upper Cook Inlet and Kenai Refuge oil fields.

Geologic Hazards

Earthquakes and volcanic eruptions are recurring geologic phenomena in the Kodiak region. Tsunamis, ground motion, landslides, subsidence, and ash falls associated with these phenomenon have occurred in the past in the Kodiak Islands and may cause future natural disasters.

Earthquakes - Being adjacent to the Aleutian Trench, the Kodiak Islands are in one of the world's most seismically active areas. The Aleutian Trench marks the trace on the ocean floor where oceanic rocks of the Pacific Plate are being thrust northwest under the North American continent.

Actual earthquakes take place in rock deeper and more elastic than trench sediments, when stress has accumulated to the point where the rock can no longer bend, and it breaks suddenly. Faults where these breaks occur are in a zone called the Benioff Zone, which dips about 45 degrees down and northwestward from the Aleutian Trench under the Kodiak Islands.

The largest earthquake of modern times in the region was the Alaska Earthquake of 1964:

> It was strongly felt throughout Kodiak Island and the nearby islands. Earth tremors triggered numerous landslides and avalanches, caused the ground to crack and subside in some areas of unconsolidated deposits, and affected water levels of streams, lakes, and wells. The earthquake was accompanied by regional tectonic warping that resulted in both extensive subsidence and local uplift of the land relative to sea level. It was followed after about a half an hour by a train of at least seven destructive, large-amplitude seismic sea waves that repeatedly inundated low lying segments of the shore. (Plafker and Kachadoorian, 1966)

The epicenter was located about 400 miles (640 km) northeast of the Kodiak Islands, but the affected local region was immediately southeast and adjacent to the islands, as indicated by the aerial distribution of aftershocks and the source of the subsequent tsunami. Landslides, subsidence, and tsunami run-ups along the coastline occurred on the refuge; local subsidence was as much as 10 feet (3 m) in areas of saturated beach and alluvial deposits. Landslides occurred mainly in the younger Tertiary rocks along the southeast margin of Kodiak Island, responding to horizontal and vertical accelerations of long-duration waves.

Regional tectonic uplifts of approximately two feet (60 cm) occurred in the islands off the southeast coast of Kodiak Island and at Narrow Cape and Dangerous Cape. All the rest of Kodiak and Afognak Islands underwent subsidence. Measurements of vertical displacements of tide gauges and of growth limits of pre- and post-earthquake organisms show a line of zero subsidence around the southwest coast of Kodiak Island to a maximum of six feet (2 m) near the city of Kodiak. Subsidence was about one foot (30 cm) at

Karluk, two feet (60 cm) along a line from Miners Point to Uyak and Kaiugnak Bays, and four feet (120 cm) from eastern Ban Island to Kiliuda Bay.

> Tectonic subsidence, augmented locally by surficial subsidence of unconsolidated deposits, has had a profound effect on shoreline morphology, intertidal marine organisms, and terrestrial vegetation. Virtually all shorelines that subsided more than three feet show clear evidence of the change, and the changes were locally noticeable where subsidence was as little as one foot. (Plafker and Kachadoorian, 1966)

The most catastrophic effect of the 1964 earthquake on the islands was the train of seismic sea waves, although they were generally destructive only along exposed coasts. Highest run-ups were along southeast facing shores; shorelines along Shelikof Strait and along the southwest shore of Kodiak Island were barely touched.

Volcanic Eruptions - Four eruptions in historic times exemplify past and probable future volcanic activity: Mount Katmai in 1912, Okmok Volcano in 1945, Mount Trident in 1952, and Mount Spurr in 1953 (Wilcox, 1959). The most violent was the Katmai eruption: about six cubic miles of ash was blown into the air, much of it carried southeast. The maximum depths of ash fall on Kodiak Island were between one and two feet (30 and 60 cm). Of the three other volcanoes, only Mount Trident, five miles (8 km) from Mouth Katmai, is windward of the islands, but most of its calculated one-fourth cubic mile of expelled ash was blown westward. A sign of more recent volcanic activity in the Mount Katmai area is a series of 1967-1975 earthquakes below Mount Snow (von Heune, Moore, and Moore, 1979).

Water Resources

Most water in the hydrologic systems of Kodiak Island is surface water. Ground water plays a minor role in the cycle because unconsolidated surficial deposits are not thick or widespread, and the bedrocks are mostly clay, slate, or some other impermeable material.

The refuge's drainages follow valleys carved by local glaciers. Three major glaciations affected the topography of Kodiak Island. The last of the three glaciations was nearly as extensive and erosive as its predecessors, and probably kept valley glaciers active until recently. Isolated ice masses still remain along the mountain crest from Mount Glottof to Grayback Mountain. The valleys, freshly deepened and straightened by ice, are still unfilled with alluvium; their rivers and streams are comparatively small.

The main watershed on Kodiak Island is the rugged mountain crest developed by ice scouring of a northeast trend of granite. From the crest, drainages generally trend northwestward toward Shelikof Strait or southeastward to the Pacific. Because watersheds on the southeast side of the island are close to the shoreline, streams on that side are short, steep, and have small drainage areas. On the northwest side, streams are much larger and may attain considerable flow. Lengths of all streams, however, are abbreviated by deep bays resulting from hundreds of feet of sea level rise since glaciation. Afognak Island lacks a well-defined watershed, because the granite trend is absent, and drainages terminate at broad saddles in less resistant rock.

Lakes on the refuge are also due to glaciation. Small rock basin lakes at higher elevations, called cirque lakes, paternoster lakes, glint lakes, or tarns, are ice-scoured depressions. Large elongated lakes, such as Karluk and Frazer Lakes, are dammed by moraines.

From water data collection sites, statistics on runoff rates, streamflow duration and recurrence rates, ground water, and water quality have been produced (Jones et al., 1978). Mean annual runoff is estimated to be from four to eight cubic feet per second per square mile (cfs/mi^2). The minimum runoff ranges from zero to 0.9 cfs/mi^2 (0.6 cms/km^2). Maximum instantaneous runoff in a representative small drainage was 457 cfs (130 cms). Lowest flows occur in coldest weather, although flows may be sustained by lake discharge and, in larger alluvium-floored valleys, by ground water. Highest flows coincide with snow melt; in large streams, glacier melt may augment flows throughout the summer. High flows also coincide with increased rainfall in late summer and fall, with midwinter thaw, or with rain when channels are iced.

Stream flow duration curves show flow variability and storage characteristics for several of the drainages in the refuge (Jones et al., 1978). Average expected flows from highest to lowest are: at least 350 cfs (100 cms) for Uganik River, 265 cfs (75 cms) for Dog Salmon Creek, 130 cfs (40 cms) for Terror River, 30 cfs (8 cms) for Thumb River, 15 cfs (4 cms) for Canyon Creek, and 10 cfs (3 cms) for Falls Creek.[a] Dog Salmon Creek is the least variable: it has the highest degree of storage, both from Frazer Lake and from ground water. Uganik River and Terror River curves also indicate long-term maintenance of both high flow and low flows; high flows are maintained from lakes, and low flows from lakes and ground water.

Low flow recurrence intervals and flood stage discharges have been graphed for the Uganik River (Jones et al., 1978). The average discharge of the Uganik River measured for seven consecutive days is expected to be less than 85 cfs (25 cms) at intervals averaging two years in length. A peak discharge of 5,000 cfs (1,400 cms) is to be expected an average of every two years.

Ground water is most predictable in stream alluvium. Bedrock wells on Kodiak Island may be successful, but depend on secondary openings. Outside the city of Kodiak, nine wells are reported in three villages: Old Harbor, Lazy Bay, and Akhiok. Seven wells in sand and gravel were successful; one in bedrock was not, but another bedrock well drilled 50 feet (15 m) deep yielded 125 gallons (470 L) per minute.

All stream and lake waters probably contain less than 60 milligrams per liter of dissolved solids. Extrapolations of suspended sediment measurements of the Uganik River from lowest through highest flows ever recorded are all less than ten milligrams per liter. Winter dissolved oxygen and pH in 22 lakes surrounding the city of Kodiak were measured by ADF&G (Jones et al., 1978). The most frequent and second most frequent measurements were, respectively, around 12 and 6 milligrams dissolved oxygen per liter; the pH ranged from 5.8 to about 6.5.

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[a] Average flows were not calculated for the Karluk and Ayakulik/Red rivers.

BIOLOGICAL ENVIRONMENT

Vegetation

Five families of nonvascular plants, with about 50 species, and 68 families of vascular plants, with over 450 species, have been identified in the Kodiak Refuge area.[a] Of the plants known from Kodiak Island, many species occur in most parts of Alaska or at least northward to the Brooks Range. Many of the same species occur in the southern half of Alaska or on the Alaska Peninsula. The coastal mainland flora is well represented on Kodiak Island, for many of the Kodiak species also occur in a narrow strip extending along the entire coast of southern Alaska. Several species of the coastal mainland reach their western most distribution at Kodiak Island (Hulten, 1969).

The northeastern part of Kodiak Island is botanically different from the southwestern part and, consequently, the refuge may be viewed as lying in two major life zones:

- 1) the Hudsonian Zone, with forests of Sitka spruce, poplar, and birch found in the more northern lowlands; and
- 2) the Arctic Zone in the southwestern portion of the refuge (most of which is referred to as the "Kodiak Refugium"), with treeless tundra and floristic composition similar to that of Arctic Alaska.

Hudsonian Life Zone - The Hudsonian bottomlands are covered by cottonwood, some birch, and willow. Under-vegetation consists of poorly developed grass associated with a vigorous growth of fern, horsetail, and fireweed. The foothills and steep slopes are commonly covered with alder thickets. Alder forms a more or less continuous belt around the mountains at varying altitudes, depending on exposure and soil. At lower altitudes, elderberry shrubs occur along the periphery of alder thickets and among scattered open spaces of subalpine meadows. At somewhat higher altitudes, meadow flora is often mixed with abundant salmonberry which, together with bluejoint grass, forms breast-high thickets that are difficult to penetrate. This association also occupies the zone above the altitudinal limit of the alder.

In the lower alpine region luxuriant alpine meadows occur, particularly along southern slopes. The flora of these areas consist of bluejoint grass, cloudberry, lupine, Indian paintbrush, wild celery, false hellebore, and wild geranium. This meadow type is closely related to the lowland meadow, although additional alpine species gives it a more colorful aspect.

Above the alder belt, alpine meadows corresponding to those of lower altitudes are found, but with somewhat different species. These meadows consist of crowberry, dwarf alpine bearberry, alpine holygrass, coiled sedge, mosses, and lichens.

Along ridges and mountain tops there is no closed vegetation. At these altitudes open vegetation commonly includes mountain saxifrage, cranberry, club moss, and Aleutian heather.

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[a] A detailed preliminary plant list is available in the Service's Regional Office, Anchorage, AK.

Griggs (1934) suggested that the forest edge is advancing in this region and believed the forest has not reached its climatic limit since the last glacial period. He stated that "timberline vegetation of Kodiak finds its proper comparison not with the timberline in the Rocky Mountains, but with the lower limit of the Hudsonian Zone and many hundred feet below the limit of trees." Bowman (1934) sampled several peat bogs in northeastern forests and established from pollen analysis that Sitka spruce appeared in fairly recent times. The advancement of the forest edge is evidenced by the present distribution and density of spruce trees on Kodiak Island. Most of Afognak Island and parts of northeastern Kodiak are densely forested, but the forest becomes sparse, with only scattered groups of spruce occurring as far south as Uganik Bay. These spruce clusters are usually a large parent tree surrounded by many smaller ones. Capps (1937) believes the forest edge is advancing at a rate of one mile (0.6 km) per century. Old-time residents assert that spruce now appears in areas where it was formerly absent. This condition is also shown by historic photographs.

Arctic Life Zone - The Arctic Life Zone is largely composed of crowberry heath that has an aspect of tundra formed by hummocks of two to three feet (60 to 90 cm) high. On top are found crowberry, lowbush cranberry, *Spirea*, blueberry, bluejoint grass, and hair grass. Between these hummocks, wet depressions support sparse stems of bluejoint grass, burnet, and wild geranium.

Large wet areas are covered by a plant association similar to that of Arctic Alaska; these areas contain dwarf birch, lowbush cranberry, Labrador tea, cloudberry, sedges, lichens, and mosses. Creeks and ponds are virtually free of floating vegetation, but *Sphagnum* mosses and a variety of sedges are common along the margins. Large areas on the periphery of ponds are covered with stands of bluejoint grass mixed with flowers of the subalpine meadow. On drier ground of the lower slopes, cover consists of willow, elderberry, fireweed, cow parsnip, goldenrod, wild celery, and thick stands of bluejoint grass. Slopes are commonly covered with alder thickets interspersed with subalpine meadow. Typically, subalpine meadow components are bluejoint grass, burnet, geranium, goldenrod, false hellebore, fireweed, bluegrass, long-awned sedge, and marsh violet. There are scattered occurrences of meadowrue, chocolate lily, sandwort, rockcress, yarrow, monkshood, northern bedstraw, star flower, and Jacob's ladder. The vegetation mat may be continuous in alpine areas, depending on altitude and exposure. On mountains of gentle relief and moderate elevations, cranberry, Aleutian heather, moss, and lichens predominate.

Whether treeless areas are to be regarded as "arctic" or not is a matter of definition. Some of the vegetation associations belong to the treeless district surrounding the Bering Sea, while other plant communities show a marked similarity to the forest flora common to the southern coast of Alaska. Vegetation on Kodiak is influenced by the absence of permafrost.

Cover Mapping

The Kodiak Refuge vegetative mapping effort was conducted during 1983 and was the result of an extensive search and compilation of related data for the refuge and nearby islands. To develop the land cover classes and related map products, high altitude aircraft imagery and spatially corrected Landsat satellite photographs were photointerpreted. The derived information was then transferred to 1:250,000 scale U.S. Geological Survey topographic base maps. These basemaps were digitized and the boundaries of the different cover classes were recorded on magnetic tapes to allow future display and creation of maps from the data by the computer. The digital data base that was prepared covers a window area over the entire Kodiak archipelago. Vegetation classes that were recorded in this manner represent units of land with a minimum area of about 500 acres (200 ha). The vegetation class names that were applied were derived from the categories given by Viereck, Dyrness, and Batten (1982). Table 4 lists the acreages of the different classes and gives a breakdown of the relative percentages each class represents for the area as a whole. Figures 10-14 show the locations of the major classes in the refuge area.

I. Aquatic

The freshwater aquatic class is relatively small in acreage and is not widely distributed over the study area. The vast majority of the acreage accounted for in the region is the total from the following water bodies: South Olga Lakes, Red, Akalura, Frazer, Karluk, Spiridon, Little River, Uganik, and Afognak lakes, Upper and Lower Malina lakes, Hidden, Laura, Portage, and Big Kitoi lakes, and several smaller bodies. In most cases, the larger water bodies are found in valleys and lowlands flanked on two or more sides by mountains or ridge lines, thus acting as drainage basins for the higher elevation areas.

The marine aquatic class includes all of the marine waters surrounding the archipelago and those marine waters of the bays, estuaries, and straits of the area.

The marine herbaceous aquatic class includes the communities of eelgrass (Zostera marina), kelps, and other algae that occur on the subtidal and intertidal zones. The class is a minor one in terms of acreage, but is important to marine fish and mammal species, and many invertebrates that are critical to the food chains of the area. Examples of this class are found as localized pockets near Cape Alitak, Aiugnak Bay, the east half of Tugidak Island, the middle of Sitkinak Island in the Trinity Island group, and to the south of Cape Barnabas of Sitkalidak Island.

II. Barrens

In the barrens classes of bedrock and unconsolidated sediments, there is a trend of occurrence on the main island for a nearly continuous pattern that follows the higher elevations in a northeast to southwest direction. In addition, numerous areas of this class branch away from the main spine and follow the higher ridges of the many peninsulas along the coasts of the island.

Table 4. Size of the cover classes mapped for the Kodiak Refuge area.

Cover Class	Cover Type	Refuge Area[a]		Out of Refuge Area[b]		Total Area[c]	
		Acres	(%)	Acres	(%)	Acres	(%)
I. Aquatic							
	Fresh Water	27,120	0.02	7,560	0.00	34,680	0.00
	Marine Water	39,640	0.02	8,078,360	0.86	8,118,000	0.72
	Unclassified Water	-------	----	320	0.00	320	0.00
II. Barrens							
	Bedrock	26,480	0.02	960	0.00	27,440	0.00
	Unconsol. Sediments	1,320	0.00	5,560	0.00	6,880	0.00
	Bedrock Unconsolidated[d]	156,160	0.09	87,840	0.01	244,000	0.02
III. Vegetation							
A. Forests	Conifer Closed	32,520	0.02	429,040	0.05	461,560	0.04
	Conifer Open	1,160	0.00	8,160	0.00	9,320	0.00
	Conifer Woodland	720	0.00	22,600	0.00	23,320	0.00
	Broadleaf Closed	45,360	0.02	14,280	0.00	59,640	0.00
	Broadleaf Open	90,304	0.05	37,040	0.00	127,344	0.01
	Broadleaf Woodland	8,480	0.00	5,080	0.00	13,560	0.00
	Dwarf Tree Scrub Open	-------	----	600	0.00	600	0.00
	Dwarf Tree Scrub Woodland	440	0.00	0	0.00	440	0.00
B. Shrub	Tall Shrub Closed	327,400	0.18	225,440	0.02	552,840	0.05
	Tall Shrub Open	262,480	0.14	137,520	0.02	400,000	0.04
	Low Shrub	209,120	0.12	82,960	0.01	292,080	0.03
	Dwarf Shrub	29,080	0.02	11,360	0.00	40,440	0.00
C. Herbaceous	Graminiod Moist	16,120	0.01	2,920	0.00	19,040	0.00
	Graminiod Wet	720	0.00	1,200	0.00	1,920	0.00
	Herbaceous Shrub Wet	35,800	0.02	16,280	0.00	52,080	0.00
	Herbaceous Shrub Moist	495,085	0.27	253,680	0.03	748,765	0.07
IV. Miscellaneous							
	Agricultural	-------	----	1,360	0.00	1,360	0.00
	Urban Development	240	0.00	3,960	0.00	41.200	0.00
	Clearcut Areas	-------	----	280	0.00	280	0.00
	Unclassified Land Cover	1,560	0.00	1,480	0.00	3,040	0.00
Totals		1,807,440	1.00	9,435,840	1.00	11,243,280	0.98

[a] Lands and waters occurring within digitized refuge boundaries.
[b] Lands and waters occurring outside of digitized refuge boundaries.
[c] Lands and waters occurring inside and outside of refuge boundaries.
[d] The snow class has been included with the hardrock unconsolidated class, which partly accounts for the large size of this class.

Figure 10. Cover type - aquatic and barren.

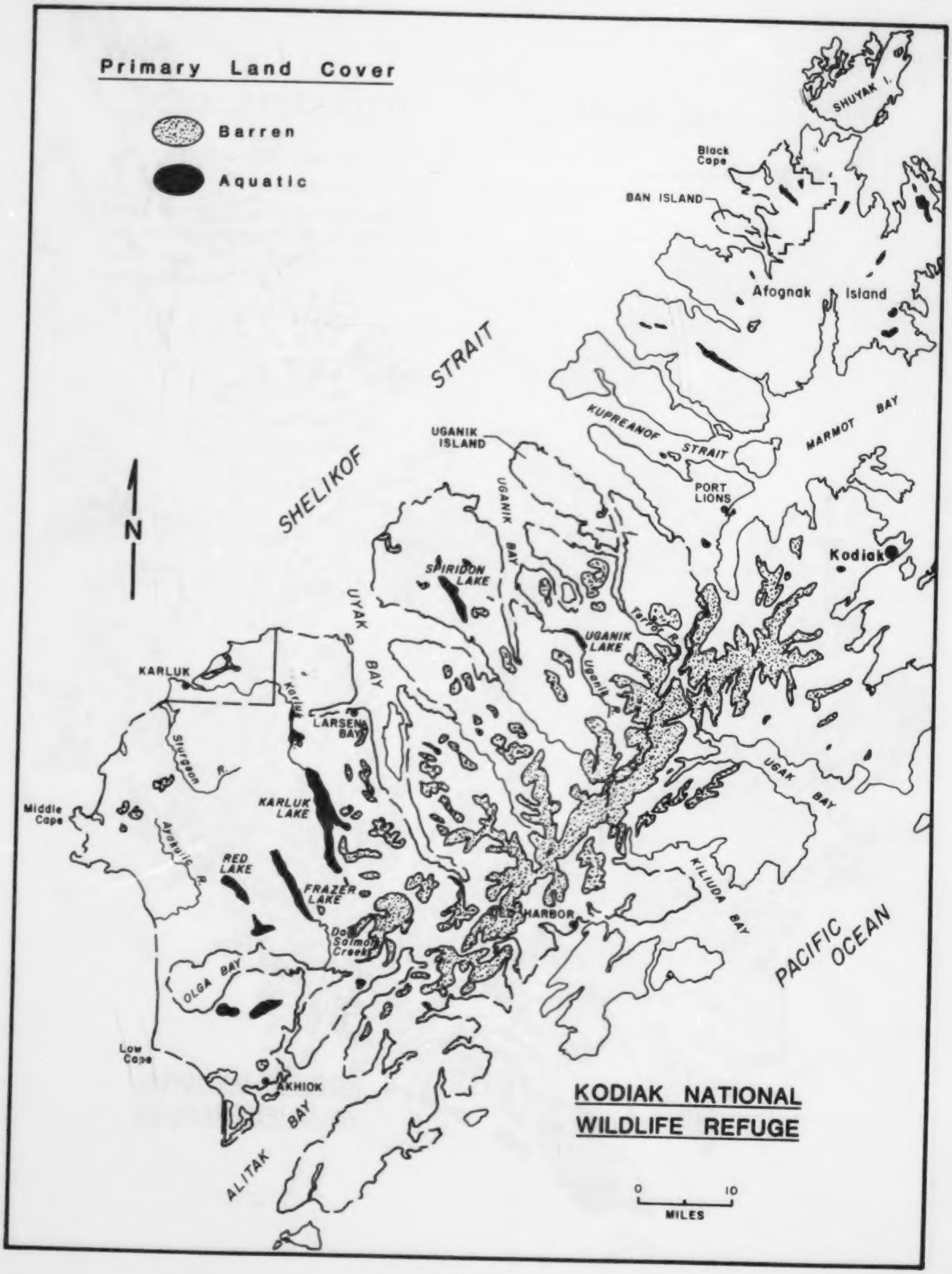

Primary Land Cover
Barren
Aquatic
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
UGANIK BAY
PORT LIONS
Kodiak
N
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Uganik R.
Terror R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
Middle Cape
Ayakulik R.
KARLUK LAKE
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
UGAK BAY
KILIUDA BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Figure 11. Cover type - herbaceous.

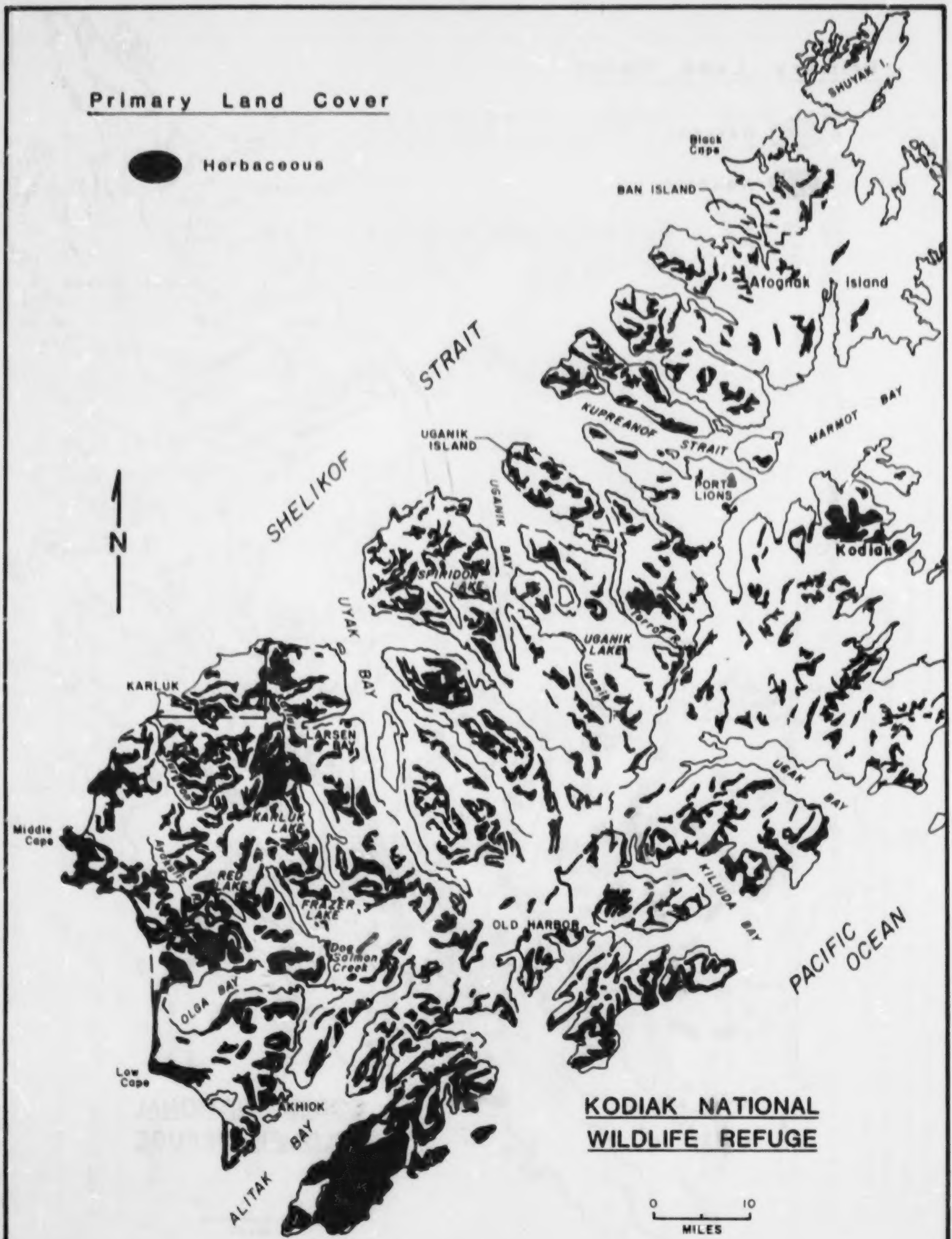

Primary Land Cover
Herbaceous
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
UGANIK BAY
PORT LIONS
Kodiak
N
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
KARLUK
LARSEN BAY
KARLUK LAKE
Middle Cape
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
UGAK BAY
KILIUDA BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Figure 12. Cover type - tall shrub.

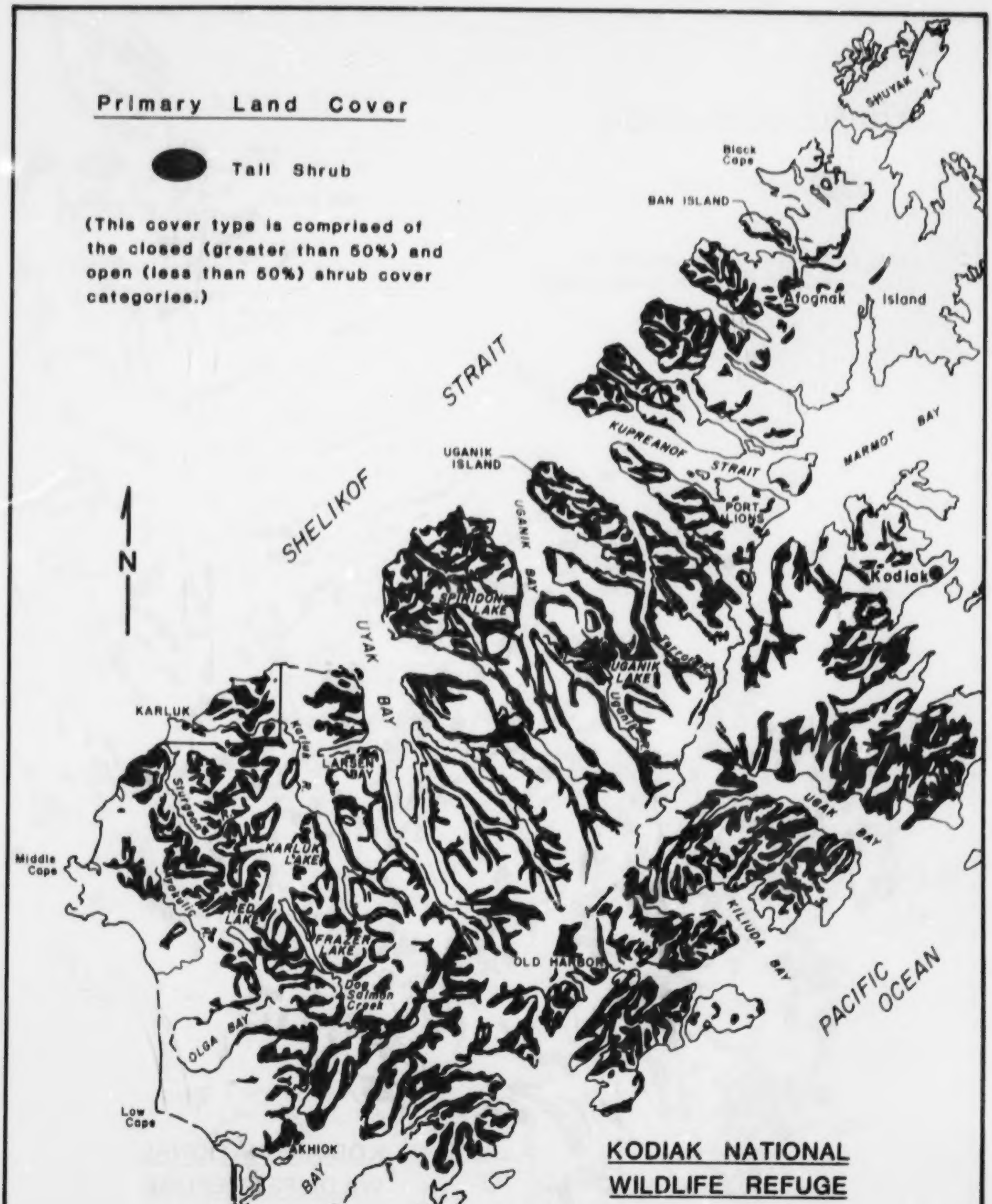

Primary Land Cover
Tall Shrub
(This cover type is comprised of the closed (greater than 50%) and open (less than 50%) shrub cover categories.)
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Terror R.
Uganik R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
KARLUK LAKE
Middle Cape
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
UGAK BAY
KILIUDA BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES
N

Figure 13. Cover type - low shrub.

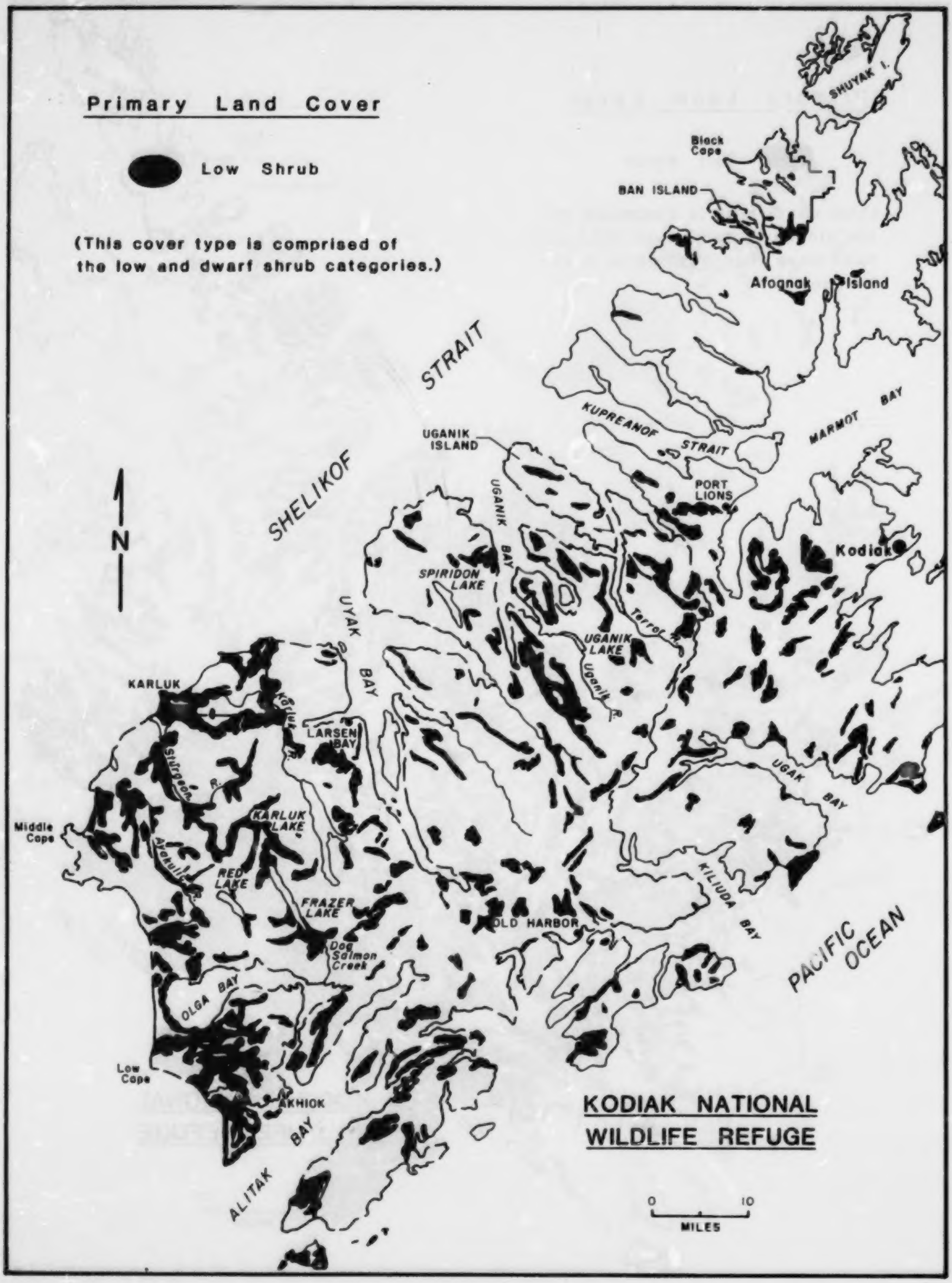
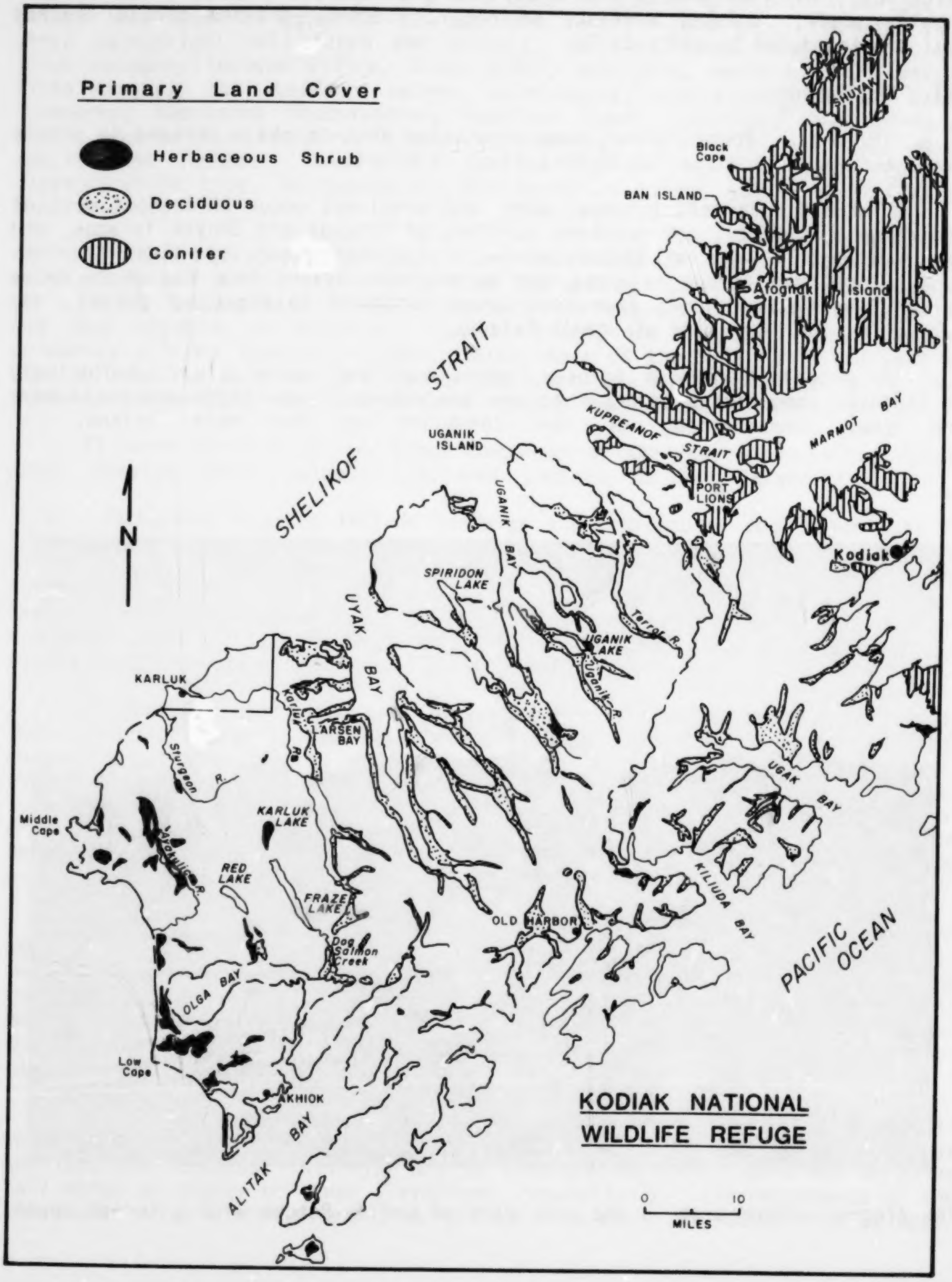

Primary Land Cover
● Low Shrub
(This cover type is comprised of the low and dwarf shrub categories.)
N
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF
STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
Terror R.
UGANIK LAKE
Uganik R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
Middle Cape
KARLUK LAKE
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
UGAK BAY
KILIUDA BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0 10
MILES

Figure 14. Cover type - conifer, deciduous, herbaceous shrub.



Primary Land Cover
Herbaceous Shrub
Deciduous
Conifer
N
SHUYAK
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Uganik R.
Terror R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
UGAK BAY
Middle Cape
Ayakulik R.
KARLUK LAKE
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
KILIUDA BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

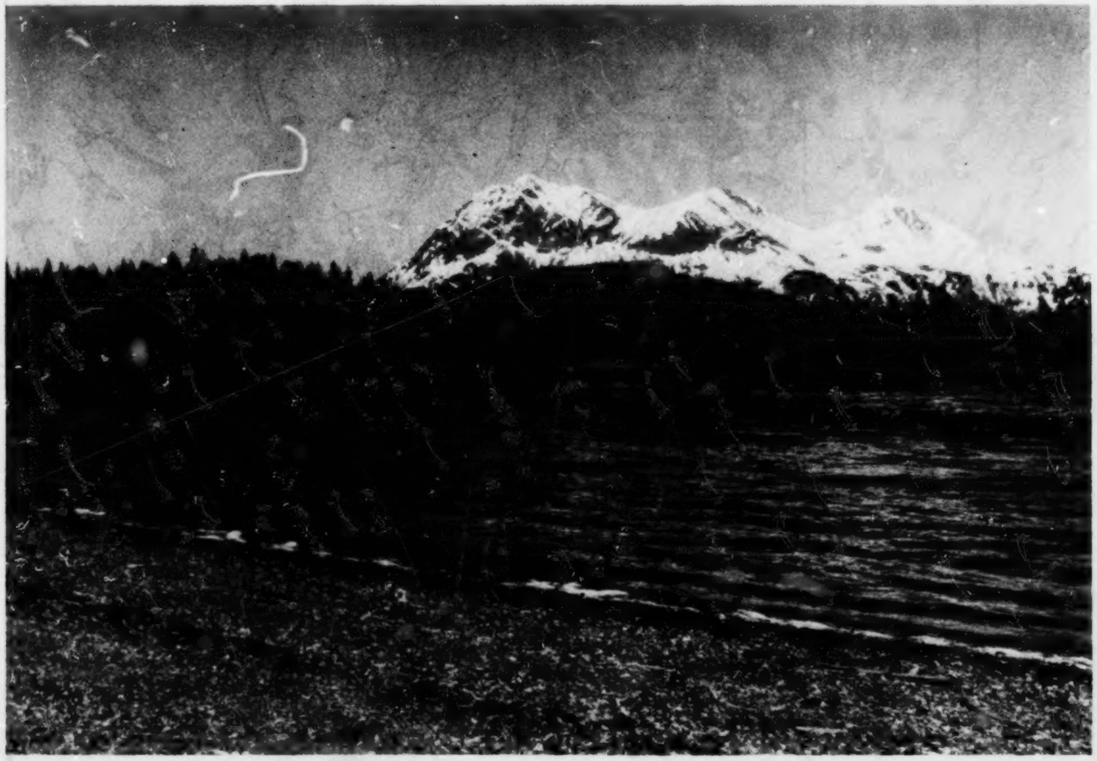
Tidal flats and breaches are common around most of the coastal bays and estuaries. Although widely scattered over the archipelago, these barrens are usually small, isolated mudflats or rocky, coarsely grained pebble beaches that are inundated by tides daily.

III. Vegetation

A. Forests. These classes have vegetation that is characterized by single stems and woody tree species 10 feet (3 m) in height.

1) Conifer forests (closed, open, and woodland) occur throughout most of the eastern, central, and northern portions of Afognak and Shuyak islands, and the northeastern edge of Kodiak Island in isolated areas like Cape Chiniak; Woody, Long, and Spruce islands; and on the main island from Kodiak to Anton Larsen Bay; Whale Island; from Port Lyons northeast to Kupreanof Strait, and part of the southern half of Uganik Island.

2) Broadleaf forests (closed, open, woodland) occur almost exclusively as isolated communities adjacent to the headwaters of drainages and small bays and along indentations of the coastline of the main island.



The Afognak Island unit is the only part of Kodiak Refuge with a forest cover.

B. Shrub. These classes have shrub vegetation with plants generally 10 feet (3 m) in height, comprising ground cover of 25% or greater. Tree species occupy less than or equal to 10% absolute cover. This group includes four shrub categories: tall (open and closed), low, and dwarf. Species in the shrub category include willow, Sitka alder, sweetgale, resin birch, Luetkea, Sitka mountain ash, beauverd spirea, salmonberry, nootka rose, devils club, crowberry, Kamchatka rhododendron, mountain heath, Cassiope, bog rosemary, alpine bearberry, cranberry, blueberry, high bush cranberry, and many other species not listed. These shrub species may be found in more than one classification type, as categories are based on height rather than species type.

1) Tall shrub is probably the most abundant cover type of the archipelago and occurs extensively from the western part of Afognak to south of Olga Bay on the main island. The hillside vegetation of Ban Island, and the land adjacent to Paramanof, Tanaak, Steep, and Raspberry capes consist primarily of this vegetation class. Also, most of the hillsides from west of Cape Chiniak to Spiridon and Zachar bays and the area northwest of a line between Larsen Bay and Akhiok are predominantly tall, dense shrub.

2) Dwarf scrub is a very minor component of the vegetation in the refuge area, forming small, widely scattered pockets on the larger island.

C. Herbaceous classes include vascular and nonvascular vegetation with 2% crown cover; these classes include scattered, luxuriant meadows dominated by bluejoint grass and broadleaf plants such as fireweed, geranium, and goldenrod. In the southwest portion of the refuge the vegetation is tundra heath consisting almost exclusively of crowberry, bearberry, lowbush cranberry, and willow. A dwarf mat and cushion tundra dominates much of the alpine zone not covered year-round by snow and ice.

1) The wet and moist sedge/grass graminoid classes form a relatively small group of cover types. The two classes are comprised of grass and sedge communities that occur on moderately to poorly drained soils and in small isolated areas ranging from lowlands and river deltas to river bottoms to subalpine meadows. Principal areas of occurrence include the lower Kupreanof Peninsula, the vicinity of Spiridon Lake, within the refugium west of a line between Uyak Bay and Olga Bay, the southern half of the Aliulik Peninsula, and a few small isolated areas on the eastern half of the main island.

2) The herbaceous shrub (tundra muskeg) class is a mix of graminoid and small shrub species that occurs on poorly drained soils and near running water in lowlands, river valleys, and muskeg. Principal areas of occurrence include the southwestern part of the refugium, the southern tip of the Aliulik Peninsula, and Tugidak and Sitkinak Islands of the Trinity group. Smaller communities are also found near Ocean Bay, the Kupreanof Peninsula, Spiridon Lake, and Aiaktalik Island.

3) The herbaceous shrub (subalpine meadow) class is a graminoid/small shrub mixture found on moderately well drained soils of mountain side slopes and subalpine meadows; this type may be interspersed with alpine mat shrub or tall shrub at higher or lower elevations, respectively. The occurrence of the herbaceous shrub class is nearly ubiquitous throughout the Kodiak Archipelago,

with the largest areas being the refugium, Sitkinak Island, the Aliulik Peninsula, and Sitkalidak Island. Most other areas show moderate to frequent occurrences of this class.

4) The bryoid class, dominated by mosses and lichens, is sufficiently small so as to not be shown for the refuge area.

IV. Miscellaneous.

These classes include most of the remaining categories that exist in the data set. They usually represent either man-induced features or unclassified data.

1) Snow and ice is a class that accounts for considerable acreage on the refuge and represents altitudes of 1,700 to 2,000 feet (500 to 600 m). This class is mainly restricted to the central ridge tops of the mountains that run northeast to southwest along the eastern half of the main island.

2) Urban development represents mapped areas of urban build-up. The only noticeable areas for this class occur around the city of Kodiak, the vicinity of Chiniak, and the village of Ouzinkie. Development has occurred around other villages, but was not visible on Landsat maps.

3) Clear-cut areas represent regions of recently cut Sitka spruce forest that tend to resemble scrub vegetation in the imagery. These areas occur on Afognak Island near Kazakof, Izhut, and Discovery bays.

4) The remaining classes of agriculture, cloud cover/shadow, and background are not available.

As indicated in Table 4, the vast majority of the refuge is represented by only six cover classes. The herbaceous shrub (moist) class is the largest single cover class within the refuge, contributing 27% of the total cover. This class is followed by the tall shrub (closed) with 18%, tall shrub (open) with 14%, and the low shrub with 12% of the total cover. Sixteen of the 26 mapped cover classes each account for 2% or less of the total cover of the refuge.

In contrast to this pattern, the land area outside the refuge is dominated by the closed conifer class, accounting for 5% of the island, and found as dense forests on Afognak and some of the northern islands.

Wetland Resources

Appendix J correlates the land cover types for the Kodiak Refuge area with the U.S. Fish and Wildlife Service's wetland and deepwater habitat classification system (Cowardin et al., 1979). Because wetlands were not specifically addressed during the refuge land cover mapping effort, many land cover types include both wetland and upland habitats. An estimate of the percentage of wetlands included in each land cover type is provided in Appendix J. The extent of wetlands in the refuge area can be determined by comparing the wetland percentage figure with the land cover type acreage data (Table 4).

Detailed wetland mapping in the Kodiak Island Archepelago is now being conducted by the U.S. Fish and Wildlife Service's National Wetlands Inventory. The wetland maps will be produced at a scale of 1:63,360 and will use a minimum mapping size of three acres (1 ha). Wetland maps covering the Kodiak 1:250,000 map area will be completed by September, 1986.

Fish and Wildlife

There are at least 207 species of fish, birds, and mammals that use Kodiak Refuge and adjacent areas. Appendix D lists the fish and wildlife species found on the refuge. A total of 13 fish, 166 bird, and 28 mammal species occur (or potentially occur) on Kodiak Refuge and adjacent lands and waters.

National Species of Special Emphasis (NSSE's)

Three fish species and three wildlife species that use Kodiak Refuge and adjacent waters have been identified by the Service as National Species of Special Emphasis (NSSE's): chinook salmon, coho salmon, steelhead trout, tundra swan, mallard, bald eagle, and sea otter. NSSE's are an internal Service designation used to focus management direction on selected species.

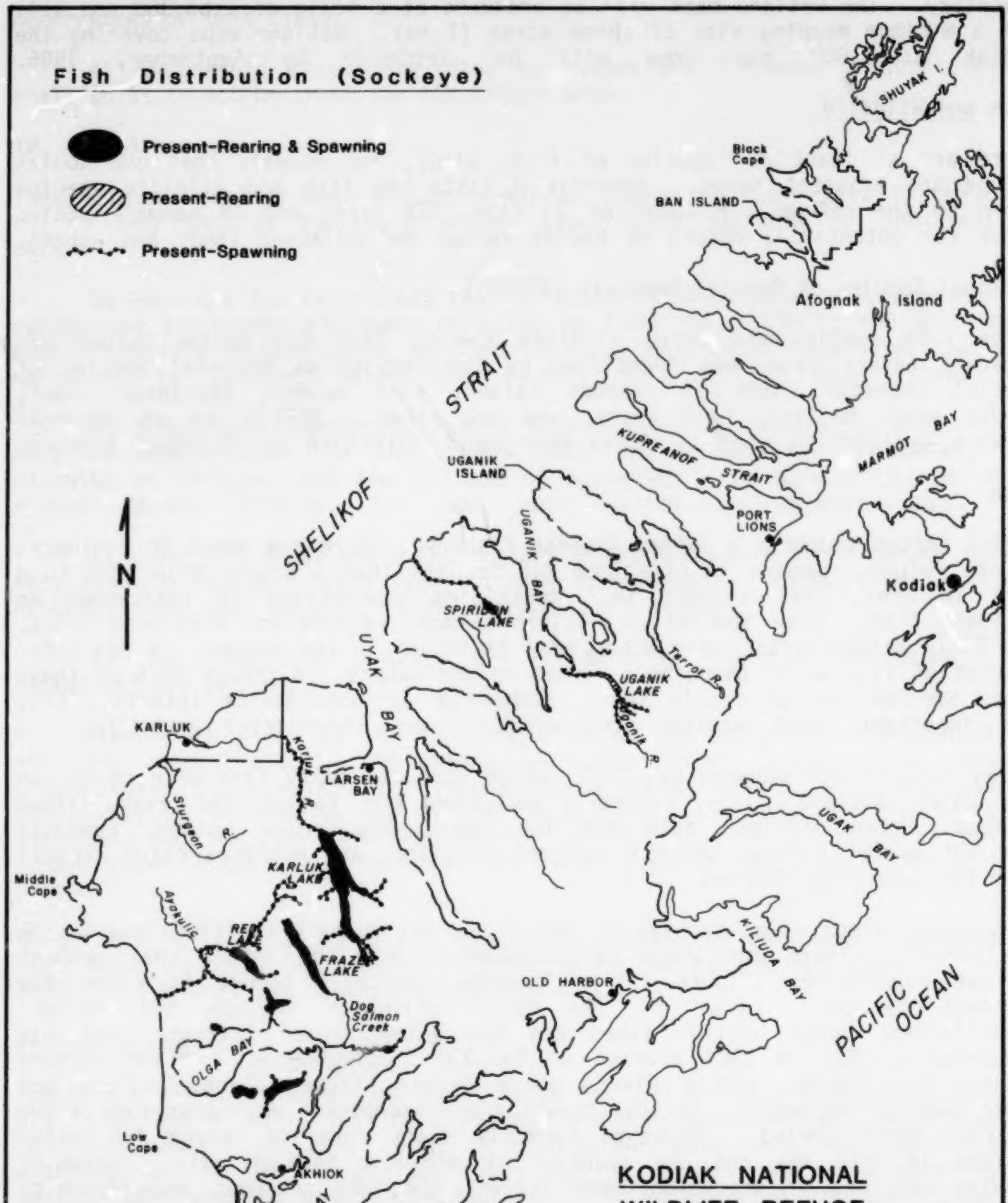
Fish

Kodiak Refuge supports a large, diverse fishery. There are about 90 drainages on the refuge, ranging in size from 236 to less than 1 square mile (600 to 2 km^2) in area, that support self sustaining populations of anadromous or resident fish. Five species of Pacific salmon, rainbow and steelhead trout, and Dolly Varden/Arctic char occur many drainages in the refuge. A few other species of fish occur throughout refuge inland waters. Although most of these other species are of little sport, commercial or subsistence interest, they are important food sources for aquatic and terrestrial wildlife.

Salmon returns are managed by ADF&G, which conducts daily fish weir counts on the major sockeye river systems, including the Karluk and Ayakulik/Red systems, Upper Station lakes and the Dog Salmon/Frazer system, conducts frequent aerial surveys and pre-emergent sampling, and monitors catch reports from the commercial fishery.

Sockeye Salmon - The sockeye is one of the key commercial salmon species on the refuge. There are about 10 drainages within the refuge that support sockeye populations (Figure 15). Spawning typically occurs in river-lake drainage systems. Four of the major drainages include the Karluk, Ayakulik/Red, Upper Station Lakes and Dog Salmon/Frazer systems; each has supported a 1979 to 1984 average of 200,000 plus spawners. Minor systems include the Uganik, Little River, Horse Marine Silver Salmon, Akalura and North Kaguyak drainages. Sockeye spawning and escapement may occur over a two to four month period. Sockeyes normally start entering refuge freshwater systems in late May and are abundant in mid-June through July. Spawning habitat consists of gravel-bottomed streams and lake beaches; peak spawning occurs from July through September. The fry emerge in late spring and migrate to and remain in the lakes for one to three years, feeding mainly on zooplankton. Sockeye smolt migrate out to sea between late May and June and spend two to three years in the northern Pacific Ocean before returning to their natal streams to spawn.

Figure 15. Sockeye salmon habitat distributions.


Fish Distribution (Sockeye)
● Present-Rearing & Spawning
▨ Present-Rearing
Present-Spawning
N
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
Terror R.
UGANIK LAKE
Uganik R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
UGAK BAY
Middle Cape
KARLUK LAKE
Ayakulik
RED LAKE
FRAZER LAKE
KILIUDA BAY
OLD HARBOR
Dog Salmon Creek
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0 10
MILES

To facilitate sockeye management on the island, a fish pass is operated on the Dog Salmon Creek below Frazer Lake to allow sockeyes into the lake and upper spawning tributaries. In addition, ADF&G operates a temporary sonar array below the outlet of Frazer Lake to estimate numbers of sockeye smolt leaving the lake in May and June.

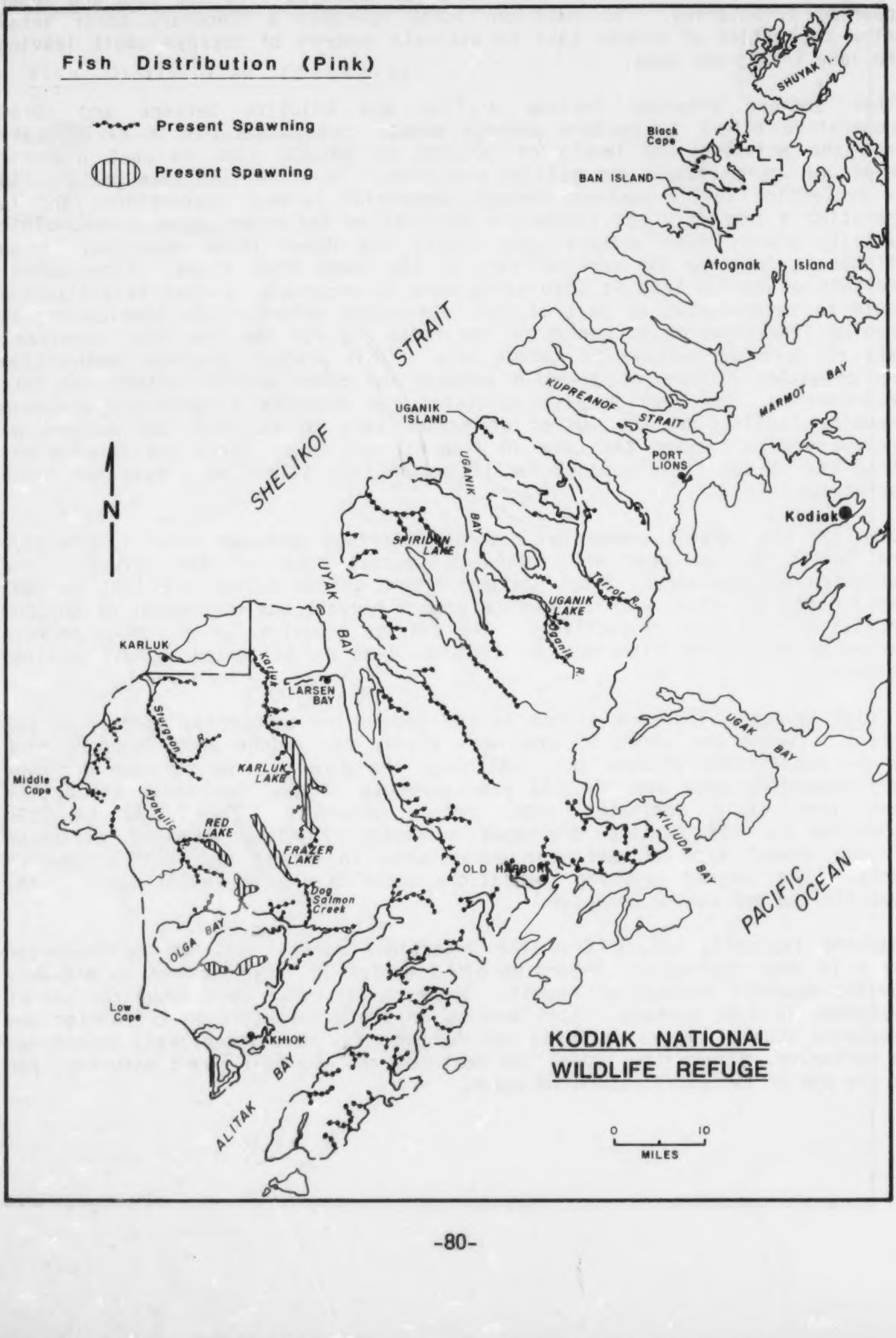
Other sockeye programs include a Fish and Wildlife Service and ADF&G cooperative effort to restore average annual sockeye returns to Karluk Lake from the existing low levels of 300,000 to 600,000 fish to past historic levels of approximately one million plus fish. To accomplish this goal, ADF&G is protecting Karluk sockeye through commercial harvest restrictions and is operating a temporary egg incubation facility on the upper Thumb River. This facility plants eyed sockeye eggs within the Upper Thumb watershed in an attempt to increase the survival rate of the Thumb River stock. Limnological analysis of Karluk Lake is also being done to ascertain if lake fertilization would be advantageous as part of the restoration effort. The Service has an ongoing investigation to determine the reason(s) for the low-level survival rate of juvenile sockeye in Karluk Lake. This project examines competition and predation factors of juvenile sockeye and other species within the lake environment. The Service also maintains and operates a temporary upstream trapping facility at the outlet of Karluk Lake to estimate the numbers of sockeye smolts leaving the Lake in late-May and June. Both the Service and ADF&G use refuge field support facilities on Camp Island as a base for field operations.

Normally, the largest commercial catches of refuge sockeyes occur in the bays and inlets on the west and southwest coastal areas of the refuge. The estimated average annual total sockeye return to the refuge for 1981 to 1983 was 1.8 million fish, with an average annual harvest and escapement of 607,000 and 1.2 million fish respectively. The average annual value of refuge sockeye harvested by Kodiak fishermen in 1981 to 1984 is estimated at 3.9 million dollars.

Pink Salmon - The pink salmon is the second key commercial species on the refuge. There are about 90 drainages within the refuge which support pink salmon populations (Figure 16). Although the pink returns to each drainage vary depending upon even or odd year strength of the individual stock, the even year cycle dominates total refuge returns. From 1979 to 1984 approximately 15% of the drainages surveyed by ADF&G received estimated average annual even or odd year escapements in excess of 100,000 spawning pinks. The largest spawning populations occur during the even years in the Ayakulik/Red and Karluk drainage.

Spawning typically occurs from the intertidal waters upstream to headwater areas in some drainages. Returning pinks arrive in large numbers by mid-July and are abundant through mid-August. Spawning can occur up through the end of September in some streams. Eggs develop in the gravel through the winter and emergence usually occurs in April and May when fry move immediately downstream to saltwater. There they spend the next one and one-half years maturing, and at the age of two years return to spawn.

Figure 16. Pink salmon habitat distributions.


Fish Distribution (Pink)
Present Spawning
Present Spawning
N
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
Terror R.
UGANIK LAKE
Uganik R.
KARLUK
Karluk
LARSEN BAY
Sturgeon R.
KARLUK LAKE
Middle Cape
Ayakulik
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
KILIUDA BAY
UGAK BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Pink returns are managed through analysis of estimated brood stock counts correlated with pre-emergent sampling on selected streams. From these data a preliminary forecast is prepared and guideline harvest levels are set prior to a fishery. ADF&G is also conducting a study to assess the \magnitude of change, if any, of pink salmon populations using the Terror and Kizhuyak rivers resulting from the Terror Lake Hydroelectric facility.

Total escapement values are only available for the four major sockeye systems where fish weir counts are available. The remaining drainages are indexed for pink escapement by ADF&G aerial surveys. It is estimated that average annual total return for pink salmon to refuge waters for 1981 to 1983 was in excess of 6.6 million fish, with an average annual harvest of 4.7 million fish. Normally the largest commercial catches of refuge pinks occurs along the bays and inlets of the west and southwest coastal zones. The average annual values of refuge pinks harvested by Kodiak fishermen in 1981 to 1984 is estimated at $6 million, about 1.5 times the average value of the corresponding sockeye harvest for those years.

Chum Salmon - Chum salmon are the third most abundant salmon species occurring on the refuge. There are 56 drainages with the refuge that support chum populations (Figure 17). Approximately 7% of the drainages surveyed by ADF&G had estimated average annual 1979 to 1984 escapements in excess of 30,000 spawning chums.

The principal systems for chum salmon, in descending order, are the Sturgeon, East and South Uyak, Spiridon, Deadman, North Sulua, East Uganik, Zachar, Dog Salmon and North Kaguyak, Midway and Terror rivers. Returning chums arrive in early July and remain numerous into late August. Chum salmon runs (with estimated average annual escapement during 1979 to 1984 in excess of 91,000 fish) are among the earliest and most important on the refuge.

Chum returns are managed by estimating broodstock production and aerial indexes of escapement to set in-season guideline harvest levels.

The average annual total return of chum to the refuge is unknown. Estimates based on weir counts and aerial survey counts indicate an average annual escapement from 1979 to 1984 in excess of 398,000 fish. Estimated average annual harvests by commercial fishermen for the years 1981 to 1984 is 534,000 fish. The average annual value of refuge chums harvested by Kodiak fishermen in 1981 to 1984 is estimated at 1.91 million dollars.

Coho Salmon - There are 24 drainages known to be used by coho within the refuge (Figure 18). Approximately 50% of the drainages surveyed by ADF&G from 1979 to 1984 received an average annual escapement in excess of 2,000 spawning coho. The principal coho systems on the refuge, in descending order are, the Karluk, Ayakulik/Red, Midway, Upper Station, Spiridon, Little River, Southeast Zacher, South Sturgeon, Akalura, Silver Salmon and Dog Salmon drainages.

Coho salmon normally return to river systems from mid-August through November, with peak runs occurring from late September to the first part of October. Coho may be present in some systems on Kodiak through December. Spawning habitat is usually small to medium size gravel at the head of riffles in shallow tributaries and narrow channels, but some coho also select mainstream

Figure 17. Chum salmon habitat distributions.

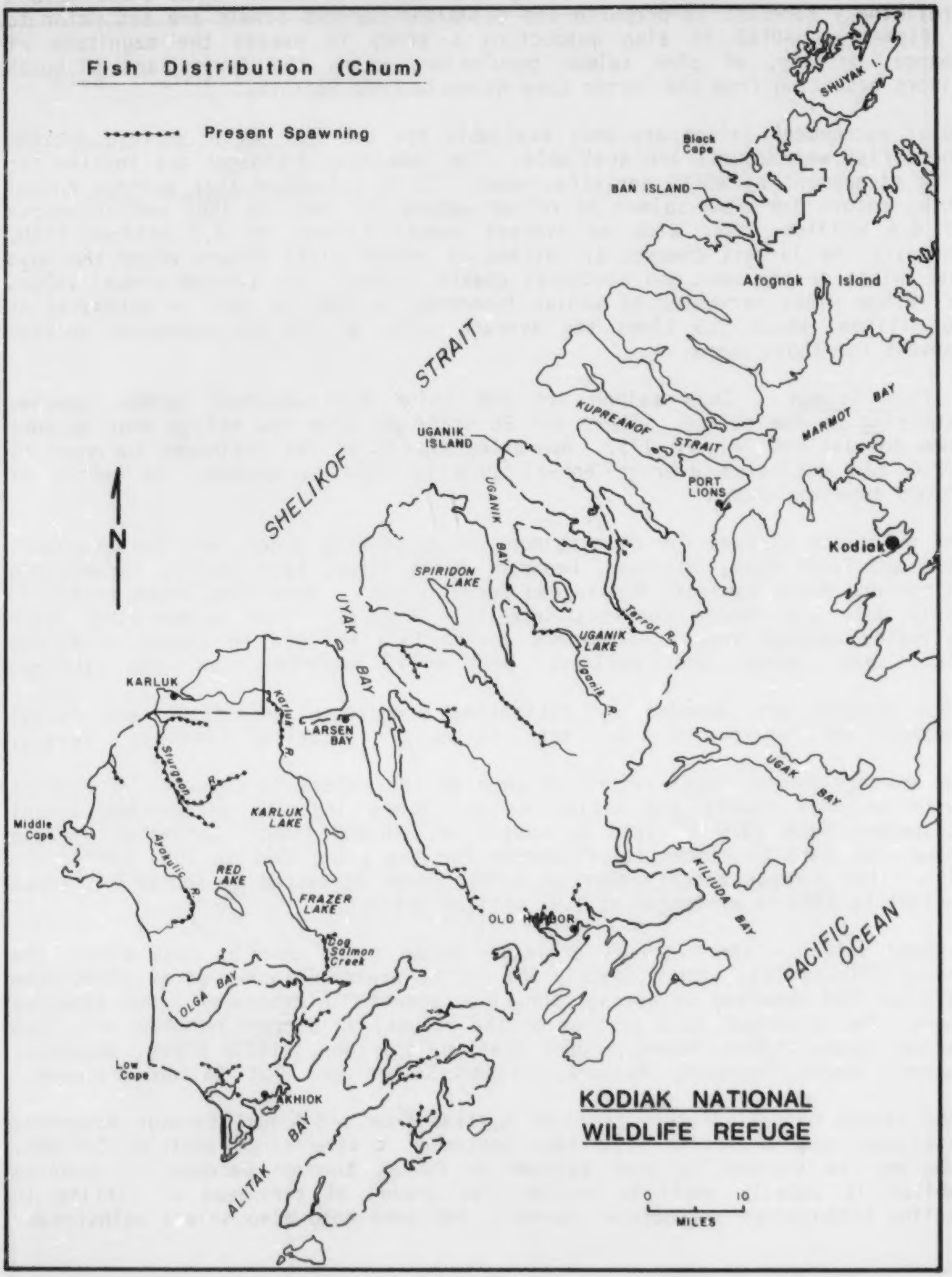
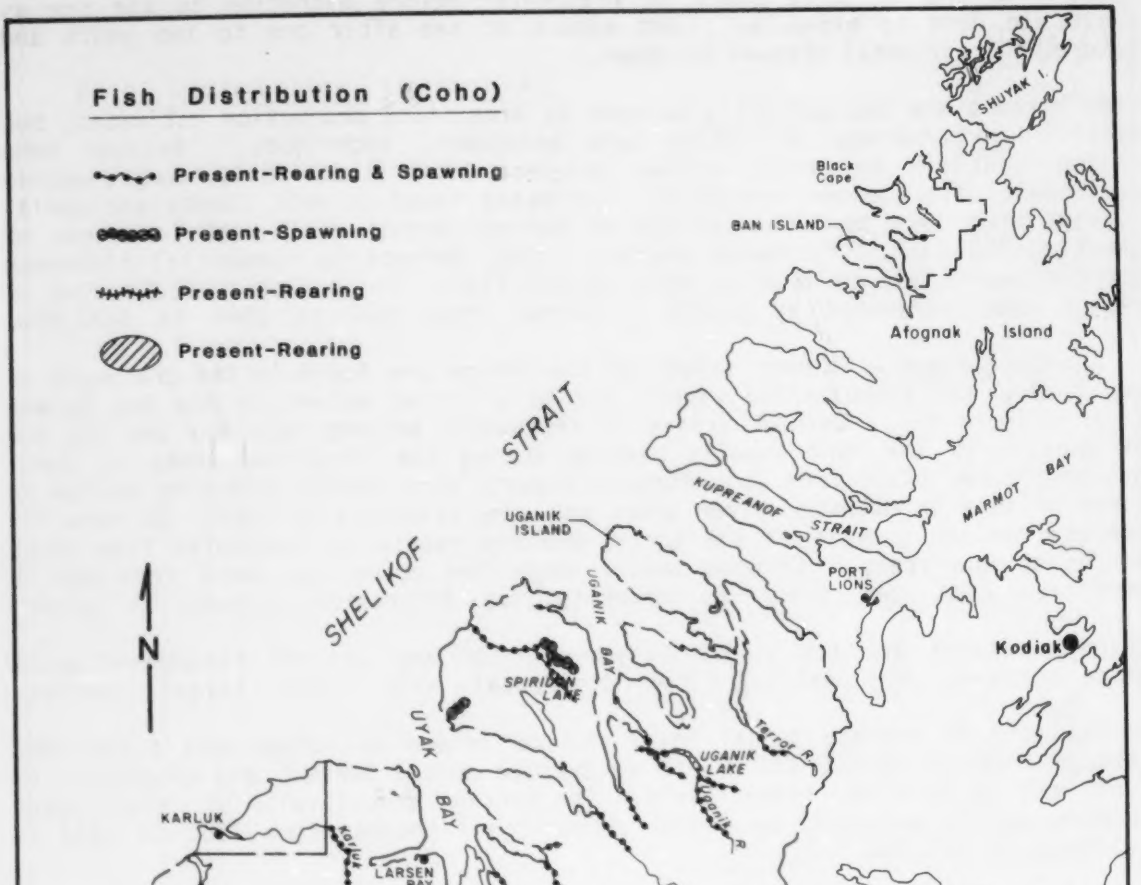

Fish Distribution (Chum)
Present Spawning
N
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
Terror R.
UGANIK LAKE
Uganik R.
UYAK BAY
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
KARLUK LAKE
Middle Cape
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLGA BAY
OLD HARBOR
KILIUDA BAY
UGAK BAY
PACIFIC OCEAN
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Figure 18. Coho salmon habitat distributions.


Fish Distribution (Coho)
Present-Rearing & Spawning
Present-Spawning
Present-Rearing
Present-Rearing
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF
STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
UGANIK BAY
PORT LIONS
Kodiak
N
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Terror R.
Uganik R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
KARLUK LAKE
UGAK BAY
Middle Cape
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
KILIUDA BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

areas for spawning. Coho fry emerge from the gravels in late spring, then spend from one to three years in freshwater before migration to the sea as smolts in June to mid-July. Coho mature at sea after one to two years and return to their natal streams to spawn.

Coho returns are not currently managed by broodstock production estimates, but efforts are underway to refine coho management techniques. Because coho salmon continue to enter refuge streams until late fall, comprehensive escapement data are not available. Estimates based on weir counts and aerial surveys from 1979 to 1984 indicate an average annual escapement in excess of about 66,000 fish. Estimated average annual harvest by commercial fishermen for the years 1981 to 1984 is about 84,000 fish. The average annual value of refuge coho harvested by Kodiak fishermen from 1981 to 1984 is $482,000.

Chinook Salmon - Chinook salmon on the refuge are found in the drainages of the Karluk and Ayakulik/Red rivers and to a lesser extent in the Dog Salmon River (Figure 19). Chinook arrive in freshwater between late May and the end of June, with the runs usually peaking during the first two weeks on June. Spawning takes place from July through August, with adults selecting medium to large gravels in mainstem river areas and some tributary streams. Chinook fry emerge from the gravels in the spring and may remain in freshwater from three months to two years. Chinook smolts enter the ocean and spend from two to four years at sea prior to returning to freshwater streams to spawn.

Chinook returns are not currently managed for any desired escapement goals since chinook are mainly taken incidental with other target species.

An estimate of average annual total chinook return to refuge waters for 1981 through 1984 was 18,000 fish, with an average annual harvest and escapement of 1,640 and 16,330 fish, respectively. The average annual value of refuge based chinook stocks harvested by Kodiak commercial fishermen from 1981 to 1984 is estimated at $23,000.

Steelhead/Rainbow Trout - Major native steelhead runs on the refuge occur on the Karluk and Ayakulik/Red drainages (Figure 20). Other systems where steelhead are present include Dog Salmon, Sturgeon, Uganik, Upper Station, Akalura and the Little River drainages. The distribution of rainbow trout is nearly identical to that utilized by steelhead (Figure 21). The major rainbow trout areas are the Karluk, Ayakulik/Red and Uganik drainages. Adult steelhead normally enter freshwater systems from August through January; peak migration periods are unknown. Spawning usually occurs from late April through May in riffle areas with small gravel substrate. After spawning steelhead adults return to the ocean. Steelhead fry emerge from the gravels in late summer and may spend one to four years in freshwater prior to migrating to the sea as smolts. Ocean residence for steelhead ranges from two to three years; some fish may return to spawn one to three times. Total annual refuge steelhead populations for all systems is estimated to range between 5,300 to 15,000 fish. The total number of rainbow trout is unknown. The economic value of steelhead/rainbow trout, in relation to the sport fishery on the refuge, has not been determined.

Figure 19. Chinook salmon habitat distributions.

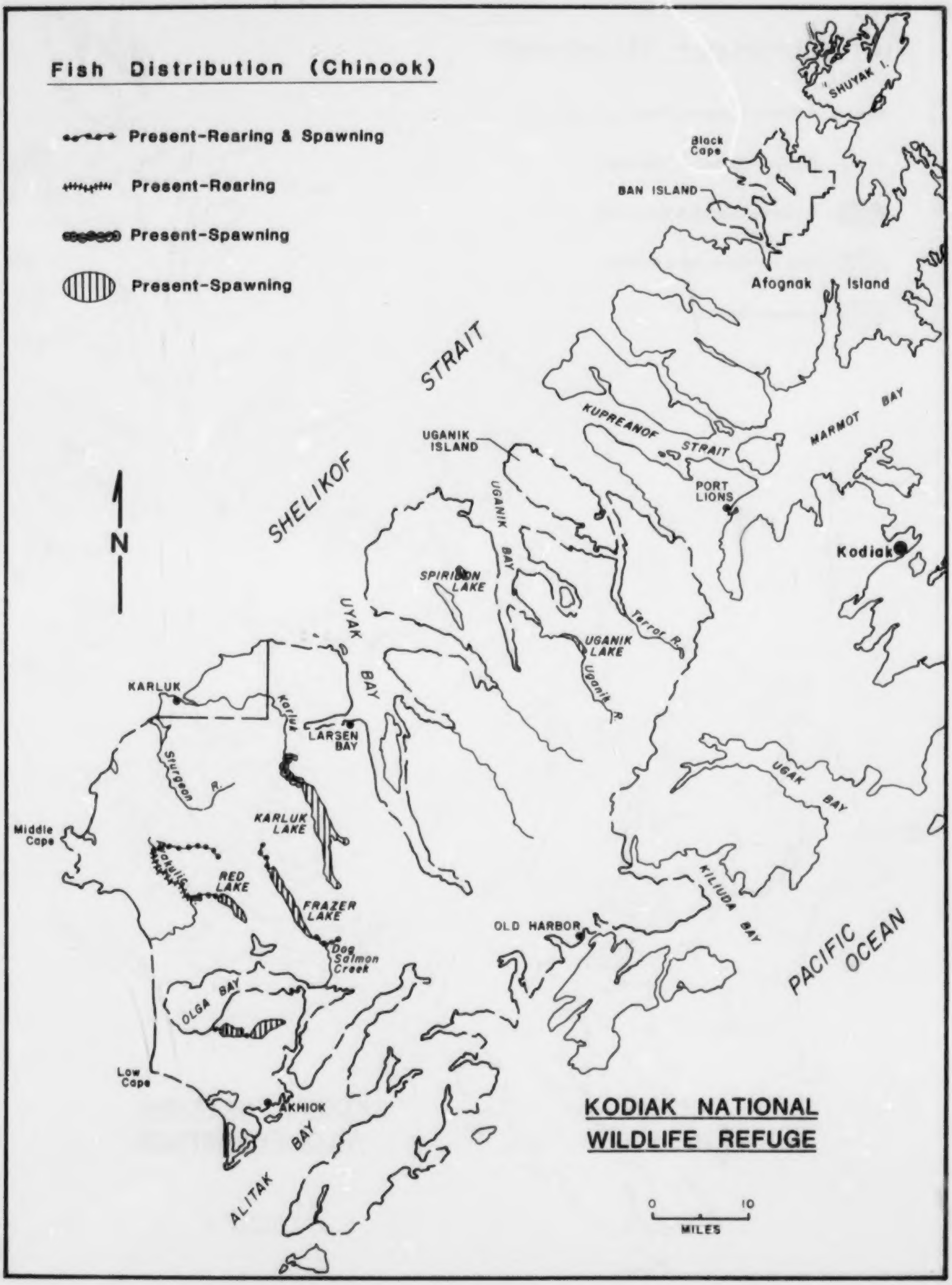
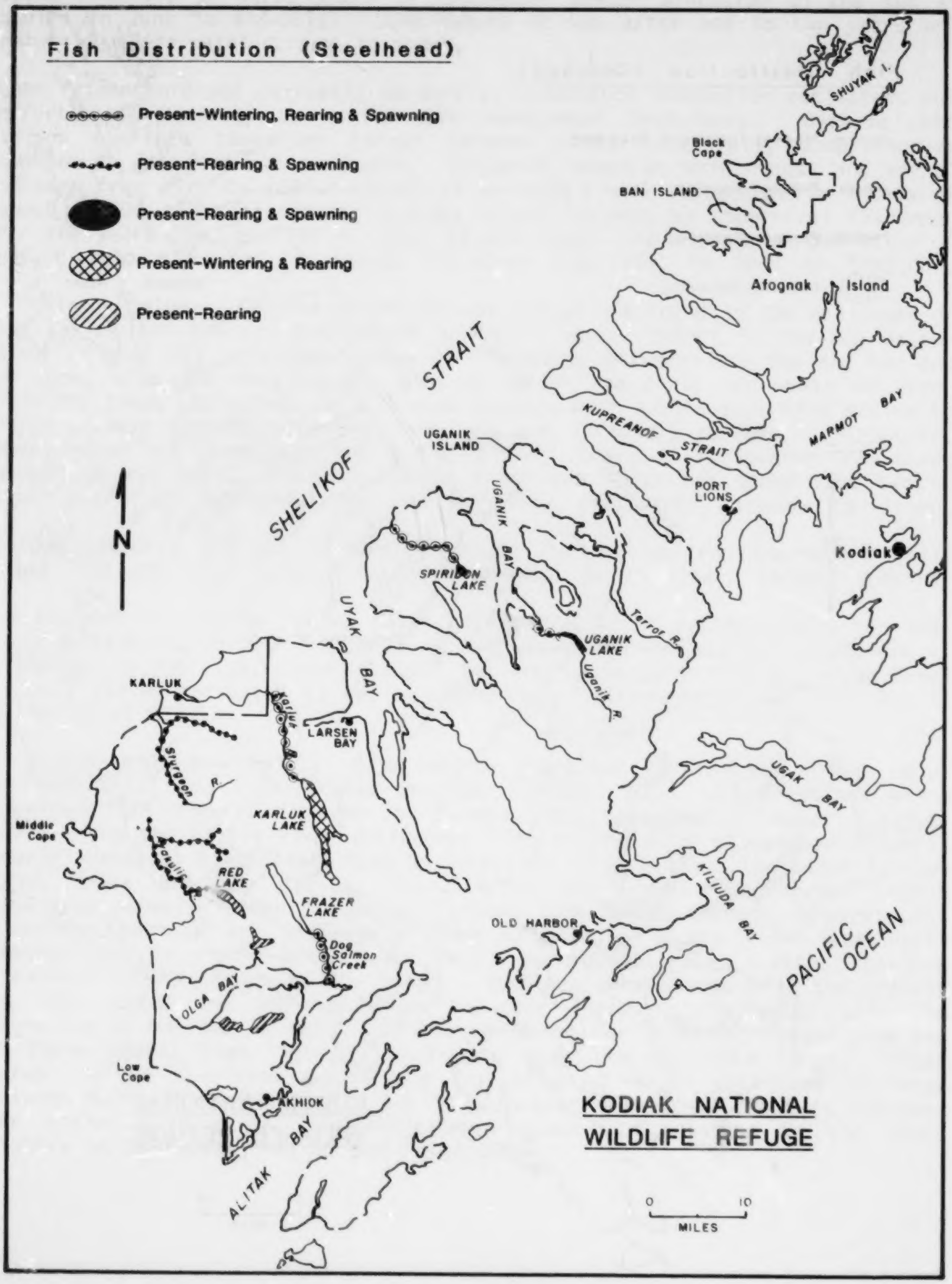
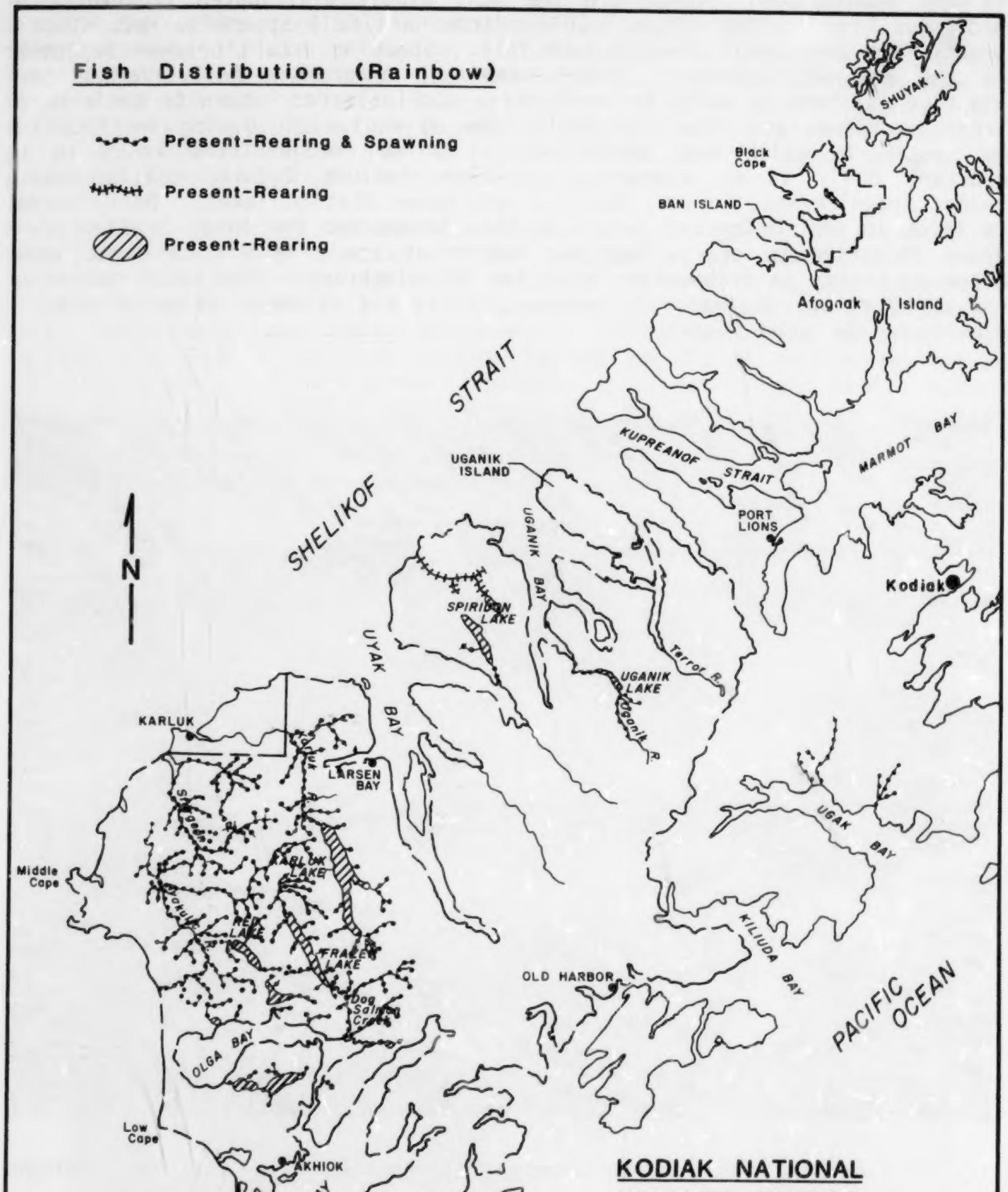

Fish Distribution (Chinook)
Present-Rearing & Spawning
Present-Rearing
Present-Spawning
Present-Spawning
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
N
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
Terror R.
UGANIK LAKE
Uganik R.
KARLUK
Karluk
LARSEN BAY
Sturgeon R.
UGAK BAY
Middle Cape
KARLUK LAKE
Karluk
RED LAKE
FRAZER LAKE
KILIUDA BAY
OLD HARBOR
Dog Salmon Creek
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
BAY
ALITAK
KODIAK NATIONAL WILDLIFE REFUGE
0 10
MILES

Figure 20. Steelhead habitat distributions.



Fish Distribution (Steelhead)
Present-Wintering, Rearing & Spawning
Present-Rearing & Spawning
Present-Rearing & Spawning
Present-Wintering & Rearing
Present-Rearing
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
N
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
Terror R.
UGANIK LAKE
Uganik R.
KARLUK
Karluk
LARSEN BAY
Sturgeon R.
Middle Cape
KARLUK LAKE
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLGA BAY
UGAK BAY
KILIUDA BAY
OLD HARBOR
PACIFIC OCEAN
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Figure 21. Rainbow trout habitat distributions.


Fish Distribution (Rainbow)
Present-Rearing & Spawning
Present-Rearing
Present-Rearing
N
SHELIKOF
STRAIT
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Uganik R.
Terror R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
KARLUK LAKE
Middle Cape
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
UGAK BAY
KILIUDA BAY
OLD HARBOR
OLGA BAY
PACIFIC OCEAN
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

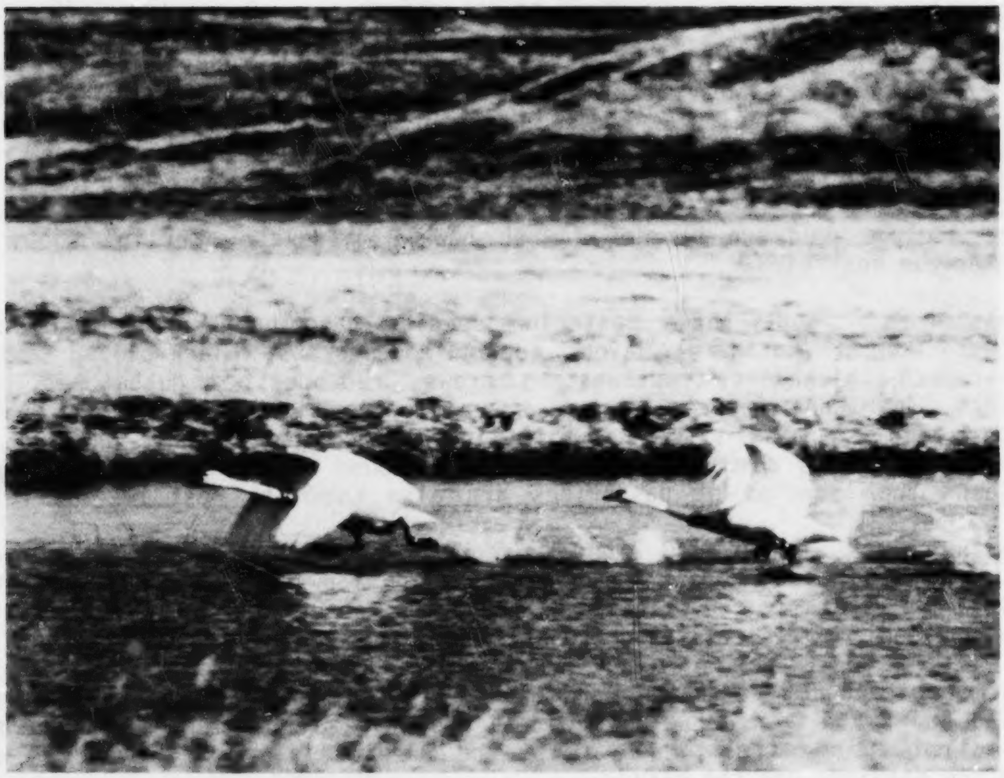
Dolly Varden/Arctic char - The refuge supports char as both anadromous and resident populations. These are the most widely distributed freshwater or anadromous fish in the refuge. Dolly Varden are fall spawners, returning to streams from mid-summer through late fall. Spawning occurs between September and the end of December. After spawning, anadromous Dolly Varden seek late-river systems in which to overwinter. Dolly Varden return to their natal stream to spawn, but they apparently have no equivalent homing instinct for the system in which they overwinter. Kodiak refuge lakes known to be important Dolly Varden overwintering areas include Uganik, Little River, Frazer, Ayakulik/Red, Karluk, Akalura, and Upper Station lakes. Dolly Varden fry hatch in the spring and remain in the streams for the three to four years before migrating to sea. They may remain at sea only six to eight weeks before returning to freshwater lakes for overwintering. The total number of char using refuge drainages is unknown, as is the economic value of char in relation to the sport fishery.

Dolly Varden are the most widely distributed fish in the refuge.

Birds

The cliffs, inlets, and bays of Kodiak's 800 miles (1,300 km) of coastline plus a variety of interior valley, alpine, and tundra areas provide abundant habitat for a large variety of seabirds and waterfowl. Kodiak Refuge does not contain the quantity of avian nesting habitat found in other Alaska refuges. Although over 80 species of birds nest on the refuge, its major importance is as a wintering area for over a million and a half pelagic seabirds and seaducks. Appendix D lists the birds found on the refuge.

Waterfowl - Breeding numbers of waterfowl found in Kodiak are insignificant when compared to other Alaska waterfowl nesting areas. The refuge's annual waterfowl production is estimated to be 2,000 to 4,000 ducks, the majority of which are diving ducks such as Barrow's goldeneyes, greater scaup, harlequin duck, red-breasted and common mergansers. Refuge estuarine marshes, river valleys, and interior wetlands provide limited amounts of nesting habitat for mallards, wigeon, northern pintail, gadwall, and green-winged teal. Emperor geese are the only resident goose species of importance that use the refuge. Migratory waterfowl stopover and staging during the spring and fall occurs in limited amounts on the refuge because the island is located off most major migration routes to southern wintering areas.



About 25 pairs of tundra swans breed in the refuge.

Kodiak estuarine lagoons support approximately 10 to 12,000 wintering dabbling ducks comprised of mallards, northern pintails, gadwalls, wigeon, and green-winged teal. The majority of the wintering population of dabbling ducks is believed to be nonmigratory.

Annual tundra swan nesting surveys conducted on the refuge since 1980 show a breeding population of about 25 pairs, with an annual production of 30 to 35 cygnets. Small numbers (10 to 14 birds) of tundra swans overwintering on the refuge near Karluk River have also been documented. Figure 22 shows the habitat distributions for tundra swans.

During the winter, refuge bays and nearshore waters support an estimated 150,000 seaducks. The most abundant wintering species are oldsquaw, followed by white-winged scoters, black scoters, king and common eiders, harlequin ducks, goldeneye sp., surf scoters, and greater scaup.

Marsh and Waterbirds - Common and red-throated loons nest on the refuge, as do red-necked grebes. Breeding numbers of these three species are very small and scattered throughout the refuge.

Shorebirds - Kodiak Refuge has minimal shorebird habitat and numbers. Species which are known to nest on the refuge include: semi-palmated plover, greater yellowlegs, spotted sandpiper, common snipe, least sandpiper, surfbird, rock sandpiper, short-billed dowitcher, and red-necked phalarope. Twenty other species have been found on the refuge.

Raptors - Thirteen raptor species are found on the refuge. Bald eagles are most common and abundant raptor to be found along the Kodiak coastline and major drainages. Figure 23 shows important bald eagle feeding and nesting habitat. Other raptors nesting on the refuge include: rough-legged hawk, northern goshawk, golden eagle, northern hawk owl, Peale's peregrine falcon, short-eared and boreal owls. Raptor migrants and accidental visitors to the refuge include northern harrier (marsh hawk), gyrfalcon, merlin, snowy owl, and American kestrel.

Passerines - Forty-three passerine species have been identified on the refuge. Common (northern) ravens, downy woodpeckers, black-billed magpies, black-capped chickadees, northwestern crows, red-breasted nuthatches, brown creepers, American dippers, winter wrens, northern shrikes, pine grosbeaks, common redpolls, pine siskins, white-winged crossbills, song sparrows, and snow buntings are common nesting and year-round residents on the refuge. Nineteen other species of passerines are also known to nest on the refuge.

Marine birds - Over 140 seabird rookeries occupied by 350,000 breeding birds are found along Kodiak's rugged coastline (Sowls et al., 1978). Tufted puffins and black-legged kittiwakes comprise about 57% and 30% of these breeding seabirds respectively. Other breeding seabirds species found along the refuge coastline include glaucous-winged gulls; mew gulls; pigeon guillemots; pelagic, red-faced, and double-crested cormorants; horned puffins; marbled and Kittlitz's murrelets; common and thick-billed murres; Leache's and fork-tailed storm-petrels; and Arctic and Aleutian terns. Figure 24 shows where the seabirds use the refuge.

Figure 22. Tundra swan habitat distributions.

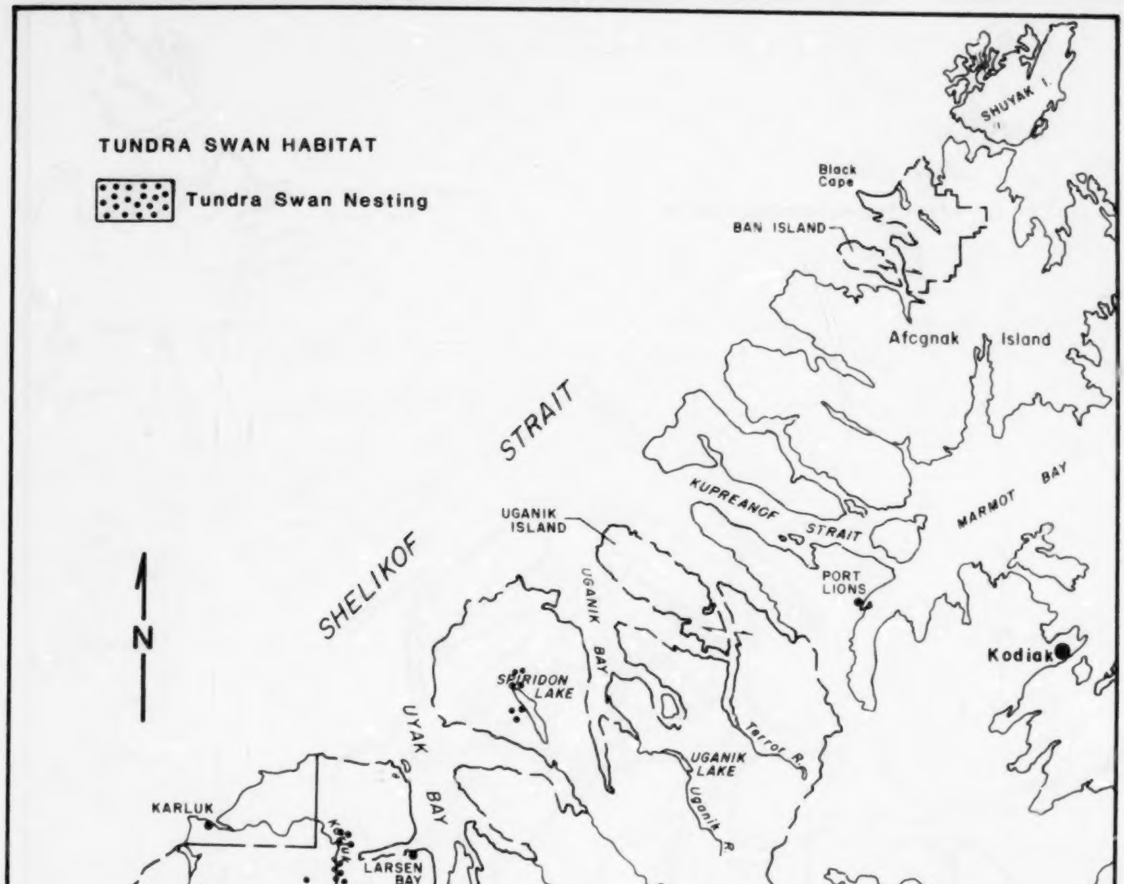

TUNDRA SWAN HABITAT
Tundra Swan Nesting
N
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Uganik R.
Terror R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
Middle Cape
KARLUK LAKE
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
UGAK BAY
KILIUDA BAY
OLD HARBOR
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Figure 23. Bald eagle habitat distributions.

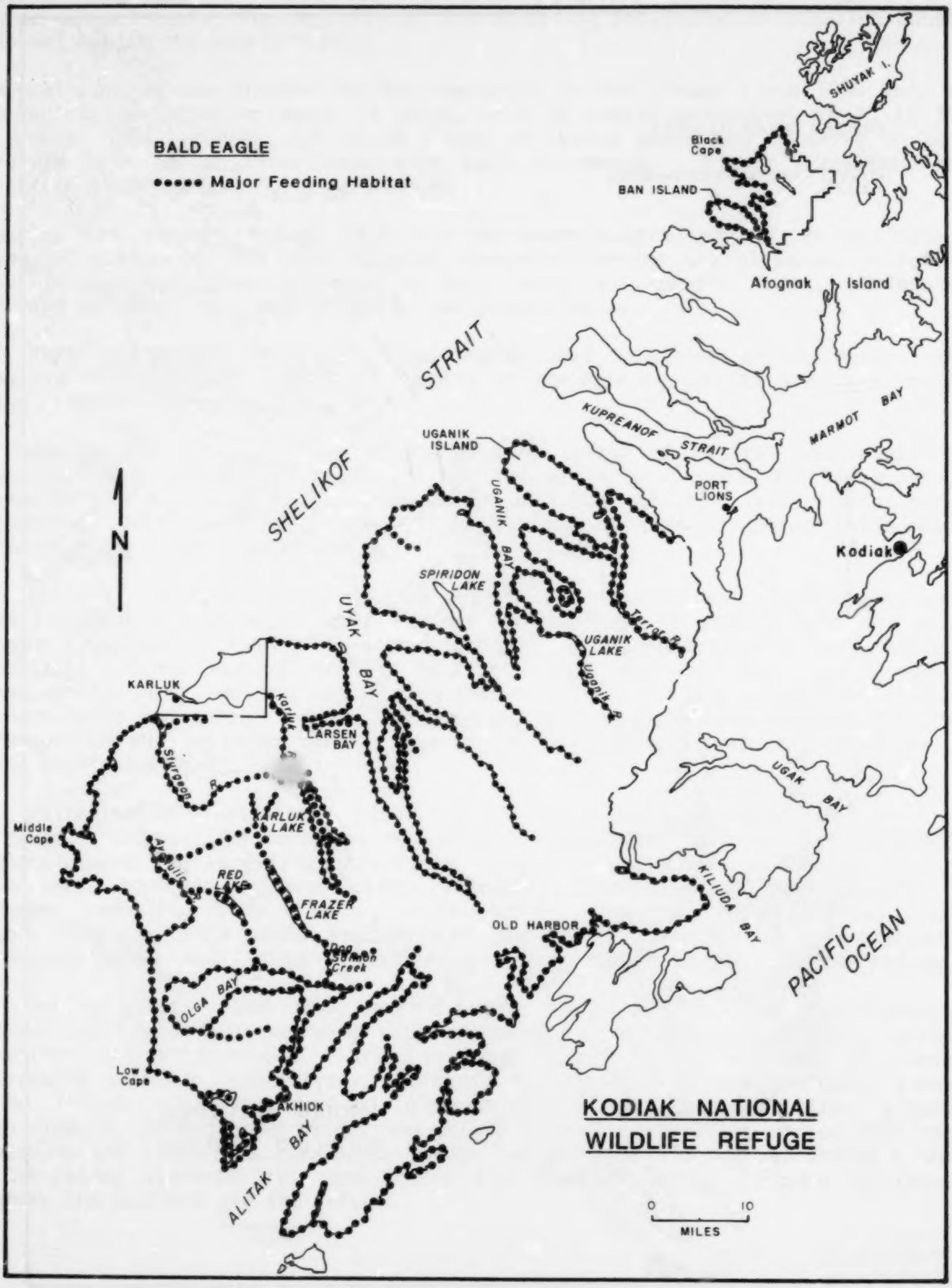
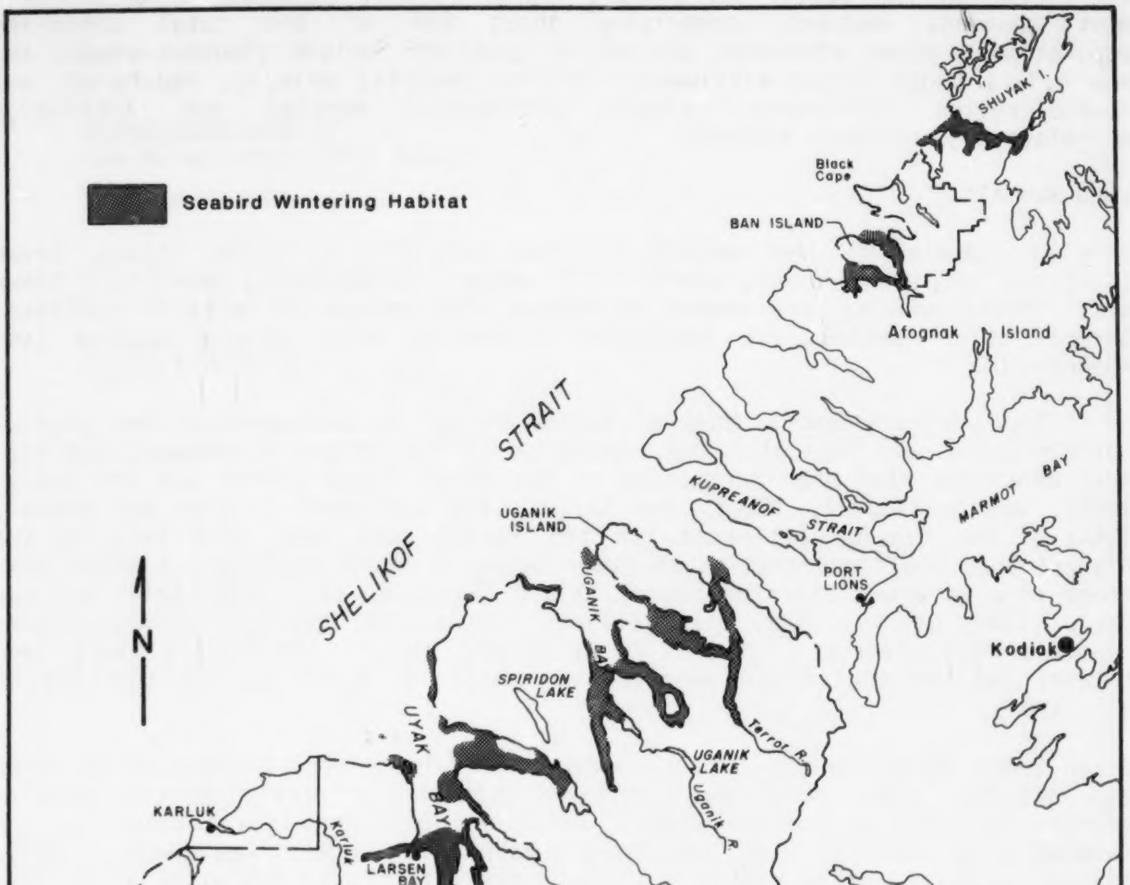

BALD EAGLE
●●●●● Major Feeding Habitat
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
UGANIK BAY
PORT LIONS
Kodiak
N
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Uganik R.
Terror R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
Middle Cape
KARLUK LAKE
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
KILIUDA BAY
UGAK BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Figure 24. Seabird wintering habitat distributions.


▨ Seabird Wintering Habitat
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
SHELIKOF STRAIT
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
N
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
Terror R.
UGANIK LAKE
Uganik R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
KARLUK LAKE
Middle Cape
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
KILIUDA BAY
UGAK BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
OK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0 10
MILES

Winter seabird surveys conducted since 1979 estimate over 1,500,000 birds overwinter in the waters surrounding Kodiak Island. Common murres are the most abundant seabird, comprising about 65% of the total wintering population. Other wintering species of seabirds include glaucous-winged and mew gulls; black-legged kittiwakes; crested auklets; pelagic, red-faced, and double-crested cormorants; pigeon guillemots; marbled and Kittlitz's murrelets; and northern fulmars.

Land Mammals

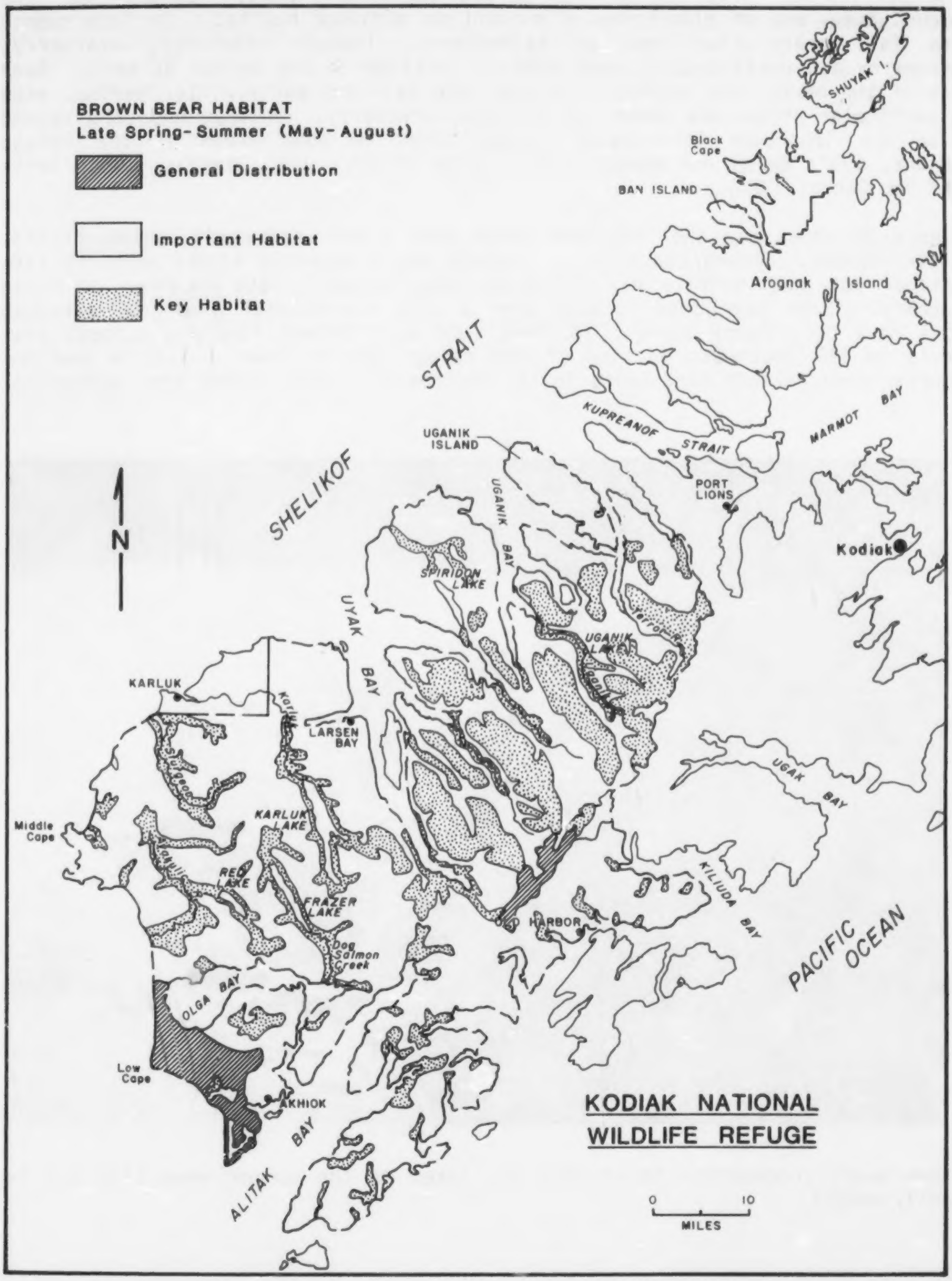
Only six species of land mammals occurred naturally on Kodiak Island: brown bear, red fox, river otter, short-tailed weasel, tundra vole, and little brown bat. These species are common throughout the refuge in suitable habitats. Several other species were introduced to Kodiak, with varying success (see Appendix D).

Brown/Grizzly Bear - Most of Kodiak Refuge is considered either good or optimum brown bear habitat. The population of the refuge is unknown, but high bear densities have been documented in the Terror River (Smith and Van Daele, 1984), Uganik (Atwell, 1980), and Karluk Lake drainages (Troyer and Hensel, 1964). The density estimated for the Karluk Lake area (1.6 km^2) is the highest reported concentration of brown bears in North America. Limited home range size of brown bears on Kodiak Island (Berns et al., 1980; Smith and Van Daele, 1984; Barnes, 1984) also reflects high quality habitat: average values reported for females (10.6-47.7 km^2) and males (24.4-141.2 km^2) are notably smaller then those reported elsewhere in North America (Ballard et al., 1982).

Brown bears on the refuge usually emerge from winter dens between early March and late May. Adult males and single adult females generally are the first to emerge, followed by females with 1 to 3-year old juveniles, subadults, and females with cubs (Troyer and Hensel, 1969; Smith and Van Daele, 1984). Females with cubs often remain near their den sites for a few weeks after they first emerge.

Figure 25 shows key and important late spring and summer bear habitat distributions. Brown bears are widely dispersed in spring as they seek out emerging forbs, sedges, and grasses on mountain slopes; some animals also descend to near sea level to feed on herbaceous vegetation and carrion (Clark, 1957). The arrival of salmon in streams and lakes causes an abrupt change in feeding habits of bears. They concentrate in lowland habitat and, more specifically, move into localized stretches of streams and lake shores where fish can be easily caught. Key areas where bears congregate include the Ayakulik/Red, Sturgeon, Karluk, O'Malley, Little and Terror rivers, Dog Salmon and Humpy creeks, the tributaries and shores of Karluk, Red and Olga lakes, and streams at the heads of Uyak, Deadman and Sulua bays (Troyer and Hensel, 1969; Barnes, 1984; Smith and Van Daele, 1984). Depending on the area, salmon are available to bears from mid-June to about mid-December. During a brief period in July and early August bears also congregate in alpine areas in the central and northern portions of the refuge--they feed primarily on nutrient-rich sedges and forbs that emerge as the snowpack recedes (Atwell, 1980; Smith and Van Daele, 1984).

Figure 25. Brown bear late spring/summer habitat distributions.

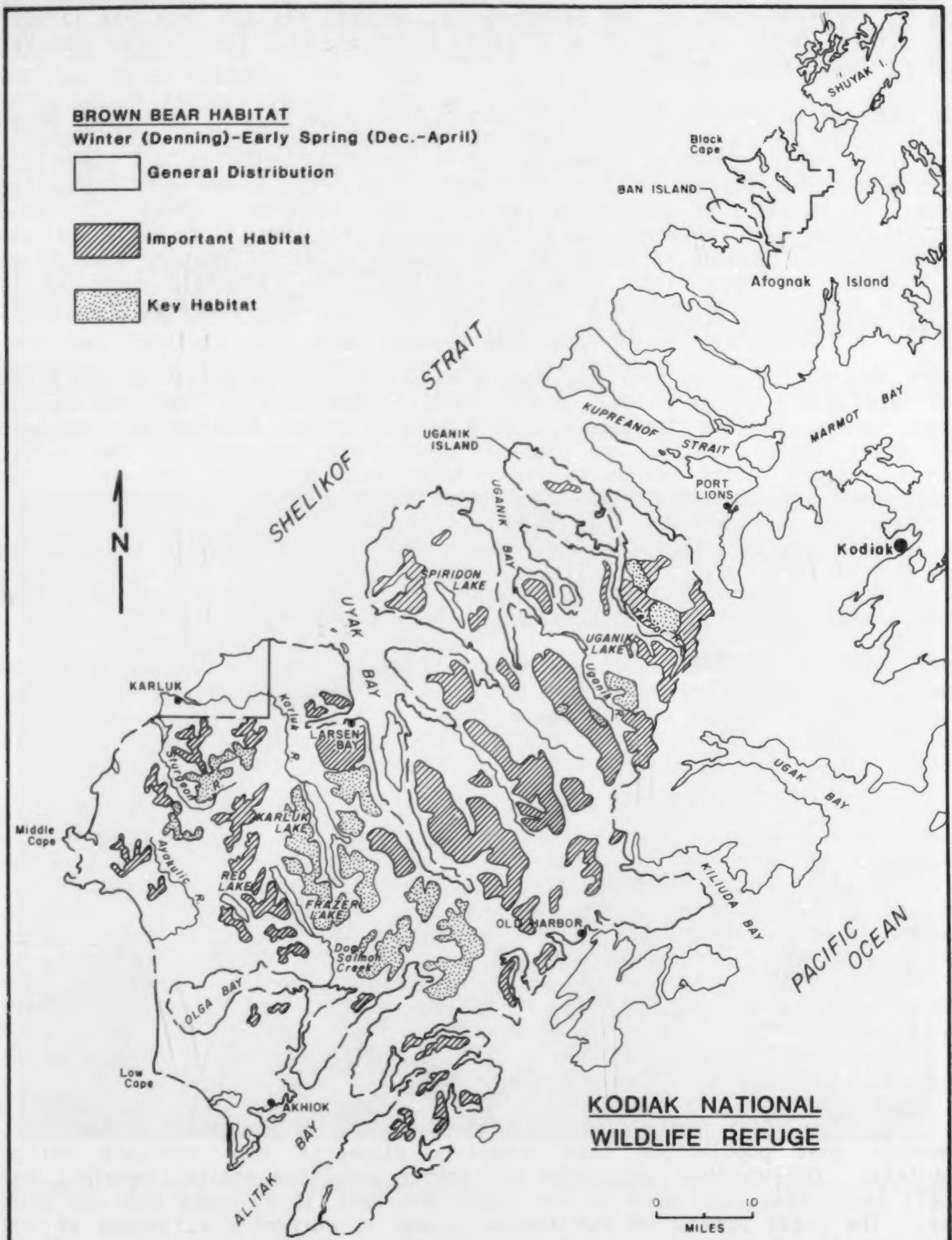

BROWN BEAR HABITAT
Late Spring-Summer (May-August)
▨ General Distribution
☐ Important Habitat
▒ Key Habitat
N
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
UGANIK BAY
PORT LIONS
Kodiak
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Terror R.
KARLUK
LARSEN BAY
Sturgeon
Middle Cape
KARLUK LAKE
RED LAKE
FRAZER LAKE
Dog Salmon Creek
UGAK BAY
KILIUDA BAY
HARBOR
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0 10
MILES

Elderberry is a highly preferred food of brown bears. Bears begin foraging on the berries in early August even before the crop ripens. By mid- to late August heavy use of elderberry is evident in midslope habitat. In late summer and fall bears also feed on salmonberry, lowbush cranberry, bearberry, crowberry and devil's club; many animals continue to use salmon as well. Bear use of the berry crop extends into the late fall and early winter period, with a particular preference shown for highbush cranberry. Sockeye and coho salmon also are important late-season forage items in some areas of the refuge (Clark, 1957; Berns and Hensel, 1972; Berns et al., 1980; Barnes, 1984; Smith and Van Daele, 1984).

Figure 26 shows key and important brown bear winter and early spring habitat distributions. Brown bears on the refuge begin entering winter dens in late October but some animals may not start denning until late December or early January. Dens have been located over a wide elevational gradient, although most have been found above 1,000 feet (300 m). Recent findings suggest that bears in the southwest portion of the refuge den at lower elevation and for shorter time periods than bears in the northeast sector. Areas that appear to

Brown bears concentrate in streams and lakes in the summer when fish can be easily caught.

Figure 26. Brown bear winter/early spring habitat distributions.


BROWN BEAR HABITAT
Winter (Denning)-Early Spring (Dec.-April)
General Distribution
Important Habitat
Key Habitat
N
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Uganik R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
Middle Cape
KARLUK LAKE
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
OLD HARBOR
KILIUDA BAY
UGAK BAY
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0 10
MILES

be particularly important for denning have been identified in the Terror, Uganik, Sturgeon and Ayakulik/Red river drainages, in the Karluk Lake area, and at the headwaters of Dog Salmon Creek, Deadman Bay and Uyak Bay (Troyer and Hensel, 1969; Lentfer et al., 1972; Berns et al., 1980; Smith and Van Daele, 1984; Barnes, 1984).

Reproductive parameters reported by Hensel et al. (1969) indicate that brown bears on Kodiak Island have a comparatively high reproductive rate (Bunnell and Tait, 1981). Females commonly attain sexual maturity at 4.5 years and have a breeding interval of 3 or more years; they probably are most productive from 9 to 16 years of age (Hensel et al., 1969; Modafferi, 1984). Breeding activity has been observed on Kodiak Island from May 1 to July 15 and parturition is assumed to occur in late January or early February (Hensel et al., 1969). Average litter size for cubs and 1 to 3-year-old juveniles is about 2.3 and 2.0 respectively (Troyer and Hensel, 1964; Hensel et al., 1969; Smith and Van Daele, 1984; Barnes, 1984).

Sport hunting for brown bear has been a major activity on Kodiak Island since the late 1940's (Troyer, 1961; Smith, 1981). From 1976 to 1980 the average sport harvest in Game Management Unit 8 (Kodiak Island Archipelago) averaged 126 bears (Smith, 1981), and 79% of the harvest occurred on the refuge (unpubl. data, Kodiak Refuge files). Males have accounted for 61% of the sport harvest during 1961-1980 (Smith, 1981).

There is little information on the magnitude of brown bear mortality caused by injury, illegal kills, or natural events. Reported defense of life and property kills (DLPs) on the refuge have averaged just over four per year from 1980 to 1984 (unpubl. data, Kodiak Refuge files).

ADF&G and the Fish and Wildlife Service's Denver Wildlife Research Center (DWRC) currently are directing two brown bear research efforts on the refuge. The ADF&G study (Smith and Van Daele, 1984) is aimed at assessing impacts of the Terror Lake Hydroelectric Project; the DWRC study (Barnes, 1984) is focused on habitat utilization and evaluation of aerial inventory procedures.

Deer - Introduced in 1934, Sitka blacktail deer have now occupied virtually all suitable habitats on Kodiak Island. A series of very mild winters in the late 1970's and early 1980's allowed deer populations to expand dramatically. Although deer hunting has become very popular in recent years, hunting activity is restricted to the most accessible areas and current harvest levels probably have little impact on the population as a whole. (ADF&G estimated a harvest of over 600 animals in 1984.) Winter weather will probably continue as the major controlling factor on Kodiak's deer populations. After the last six relatively mild winters, population levels have expanded to the point that large winter die-offs are probable if and when a severe winter does occur. Deer occupy (at least seasonally) virtually all vegetative zones from sea level to alpine areas.

Mountain Goat - Originally introduced outside the refuge boundary, mountain goat populations have gradually pioneered into suitable refuge habitats. Considerable unoccupied or lightly populated habitat remains, but small bands have been seen as far south and west as Kaiugnak Bay and Uyak Bay. The total population for Kodiak Island is currently estimated at 400 plus animals, the majority of which inhabit the north eastern one-third of the island.

Reindeer - Thirty-two reindeer were introduced to Kodiak in 1924 for husbandry purposes. The animals were actively herded until the late 1930's, when they escaped from herders and were never rounded up. At that time the herd was thought to number approximately 1,500 animals. The herd has now declined to an estimated 300 animals. Disease or poor range conditions may be contributing factors in this decline. Population levels over the past six years appear to be relatively stable. Reindeer now occur in scattered herds from the Karluk Lake drainage south and west. The Ayakulik/Red River flats from Red Lake north to Halibut Bay and Grant's Lagoon are the favored habitat of the animals.

Beaver - Beaver, originally introduced, are now very common throughout the Kodiak Archipelago, occupying even marginal habitats in large numbers. Beaver impoundments have significantly modified some habitat areas on the south west end of Kodiak by flooding. These impoundments provide additional waterfowl habitat, but some beaver dams may cause disruption of salmon movements into small tributary streams. Although the net effect of this disruption is unknown, it is not believed to be significant in most areas.

Mountain goats have been successfully introduced onto Kodiak Island.

River Otter - River otter are found throughout the refuge in suitable habitats. The refuge's population density is known only from trapping records. Thus, areas with good access near saltwater bays have the greatest reported populations.

River otter are probably the most susceptible furbearers on the refuge to trapping pressure.

Red Fox - Found in all its color phases, the fox is common throughout the refuge. Incidental observations in the field and reports indicate stable fox populations. Red fox, one of the island's two most important furbearers, may be taken by both traps and gun on Kodiak Island.

Marine Mammals - Harbor seals and Steller's sea lions are common throughout the Kodiak Archipelago. Sea otters occur in abundance only on Shuyak, Afognak and Raspberry islands, and the most northern portions of Kodiak Island. Large numbers of otters use Paramanof and Foul bays in the Afognak Island unit of the refuge.

Gray whales migrate along Kodiak's southeastern shore during their annual migrations. Sei, humpback, and fin back whales occur in small numbers in the bays of Kodiak Island. Killer whales are frequently seen in nearshore areas. Minke whales and Dall and harbor porpoises are relatively common in Kodiak waters.

Very little information is available regarding numbers of any of these species in the Kodiak area.

Threatened and Endangered Species--Plants and Animals

Endangered gray, humpback, sei, and finback whales occur in the waters off the refuge. The tundra peregrine falcon is believed to be a rare winter visitor to Kodiak Island.

No proposed threatened or endangered plant species are known to occur on the refuge.

HUMAN ENVIRONMENT

History

Although the first clear evidence of human occupation of Kodiak Refuge dates to around 6,000 years ago, it is likely that people had reached the island somewhat earlier. Some sites nearby on the Alaska Peninsula date to at least 9,000 years ago, and sites elsewhere in Alaska are at least 11,000 years old. No sites of such early dates have been identified on Kodiak as yet.

The earliest known occupation on the island was by people of the Ocean Bay tradition. This tradition has been divided into two stages, Ocean Bay I and II. The major differences between the two (falling around 4,500 years ago) was the change from a technology heavily dependent on chipped stone tools to one that strongly emphasized ground slate as a tool material.

The Ocean Bay tradition was followed by the several phases of the Kachemak tradition, which, in turn, about A.D. 1100, seems to have developed into the Koniag phase. The Koniag Eskimo were the native occupants of the island at the time of European contact.

In general, this outline of the prehistory of Kodiak Island is very similar to that of nearby sections of the Alaskan mainland, from Prince Willian Sound and Kachemak Bay areas to the north around to the Pacific Ocean side of the Alaska Peninsula. It is a distinctly different developmental sequence than the one that preceded it north of the Alaska Peninsula. Table 5 presents a summary of the prehistoric sequence of the refuge. All of the groups discussed here were primarily maritime-oriented, depending heavily on sea mammals and the islands strong run of anadromous fish for their livelihood.

The first European sighting of the island of Kodiak occurred in 1741. Both ships of the Russian expedition that discovered Alaska sighted the island in the summer of that year, although no landings were attempted. The first white man to land on Kodiak was probably Stephan Glotov in 1762.

There was sporadic contact between the Russians and the Natives of the island for the next several years; the first European settlement on the island was established in 1784, by Gregorii Ivanovich Shelikov at Three Saints Bay. After the original settlement was destroyed by a tidal wave, the Russian headquarters were moved to the location of the present-day city of Kodiak in 1792. During the Russian period virtually all of the European interests in the area focused on furs, with the Russians in a dominant position over both the Koniag people and the Aleut and Creole (mixed Native and Russian) hunters that they employed in the trade.

Table 5. The prehistoric sequence for the Kodiak area.

Date	Phase	Characteristics
Post 1763	Historic Koniag	Russian interaction with and subjugation of Koniag Eskimo. At first, indigenous culture persists.
110 A.D. to contact	Koniag Archaeological phase	Identified with and leads into historically known Koniag division of Pacific Eskimo. Regional ceramic and aceramic varients.
100 B.C. to 1100 A.D.	Later Kachemak: Three Saints and others	Developed Kachemak tradition, based on earlier Kachemak, last centuries may be transitional to Koniag phase.
1500 B.C. to 100 B.C.	Early Kachemak: Kachemak I, II, Old Kiavak	An ancient southern Eskimo culture, at first not elaborate. Partial return to chert flaking, swaing and scraping uncommon in slate work.
2500 B.C. to 1500 B.C.	Ocean Bay II	Overwhelmingly characterized by large sawn, scraped, and ground implements of slate. Very little flaked stone, but developed out of Ocean Bay I.
4000 B.C. to 2500 B.C.	Ocean Bay I	Mostly flaked chert implements, beginning of slate working.
Earlier	---	Probable initial occupation as yet undiscovered, except blade/microblade producing culture as is known from parts of Alaska Peninsula.

Source: Clark, 1979

After the American purchase of Alaska in 1867, furs continued to be a major emphasis until overhunting in the last part of the century nearly destroyed the sea otter population. Whaling was also important in the area during the middle part of the nineteenth century. Fish became the most important economic resource for Kodiak residents, beginning with salmon and including crabbing after about 1950. Mining, ranching, and logging have been comparatively minor activities on the island.

Archaeological Sites - A substantial amount of archaeological work has been done on Kodiak Island beginning with Ales Hrdlicka in the 1930's, and including work by Robert Heizer, William Workman, Donald Clark, Frederick Milan, and others. This work has resulted in the Alaska Heritage Resource Survey including 187 historical or archeological sites on Kodiak Refuge, and many others on adjacent non-refuge lands. A map of known sites appears to show concentrations of sites in some areas; it should be noted that these actually represent areas of concentration of archeological work rather than areas where the actual site density is high. It is very likely that many more sites remain to be discovered on the refuge.

The great majority of known sites on the refuge are immediately along the coast, and it is along the coast (especially at harbor mouth spits and near the mouths of salmon-bearing streams) that most as yet undiscovered sites are likely to be located. The presence of sites inland, especially along salmon-bearing streams and lakes, is also very likely.

Population Patterns

Residents of Kodiak, Akhiok, Old Harbor, Karluk, Larsen Bay, and Port Lions regularly use the refuge for recreational and subsistence purposes. These communities are therefore the focus of this section.

Population Trends

The number of Kodiak Island settlements has widely fluctuated over periods of recorded history, but as of 1984 there were seven occupied and legally designated communities (Table 6). The city of Kodiak is the major trade and manufacturing center for the island borough.

The population sizes of the Kodiak Island communities display significant seasonal surges as workers enter the summer job market. Fish processing accounts for the primary industrial land use in the borough and is the largest civilian employer of both seasonal and permanent workers. Table 7 indicates the population fluctuations that occur as people move in and out of the seasonal work place.

From 1970 to 1980, the six rural communities increased their total population by 20%. This was the same increase reported for the city of Kodiak during the same decade.

In 1982 and 1983 the Kodiak Island Borough conducted special population updates of its residents (Table 6). The special 1983 Borough census recorded a total of 13,080 residents, a 24% increase over the 1980 official census figure. The population of Larsen Bay grew 13% in two years since the 1980 census, while the Port Lions population grew 35%.

Table 6. Population sizes of Kodiak Island communities.

Community	1970 Census	1980 Census	% Change 1970-80	1982 Borough Census	% Change 1980-82	% Change 1970-82	% Natives 1980	Projected Year 2000	Projected % Change 1980-2000
Akhiok	115	105	-8.7	103	-02	-01	96		
Karluk	98	94	-4.1	102	09	04	100		
Larsen Bay	26	168	25.0	190	13	51	68		
Old Harbor	290	340	16.0	355	07	22	92		
Ouzinkie	160	173	8.1	233	35	46	82		
Port Lions	227	215	-5.3	291	35	28	68		
Kodiak City	3798	4756	20.1	5873	24	55	--	15,855	233%
Kodiak Borough	9409	9945	5.4	12714	28	35	20	21,046	11%

Source: Alaska Department of Community and Regional Affairs, 1981.

Table 7. Duration of village employment.

	Total Labor Force	Summer Employment Number	(%)	Year-round Employment Number	(%)	Nine-month Employment Number	(%)
Akhiok	40	32	80%	5	12%	3	7%
Karluk	31	20	64%	5	16%	3	19%
Larsen Bay	52	100	100%	6	11.5%	6	11.5%
Old Harbor	190	100	100%	13	7%	31	16%
Ouzinkie	64	55	86%	6	9%	3	5%
Port Lions	166	52	31.3%	26	15.7%	88	53%

Source: Alaska Dept. of Health & Social Services, Division of Public Health, 1979.

Future Growth - The recent collapse of the shellfish industry has closed several shoreline processing facilities in the city of Kodiak. A small portion of the personnel employed in the fish processing industry (an estimated 12% of the permanent work force) relocated outside the Kodiak Island Borough in 1984. However, new population and economic growth is anticipated in the near future as fish processors convert to new bottom fishing technologies.

Potential population growth could occur in the future if offshore oil development potential around Kodiak Island proves economically feasible. In 1981, the federal government leased 13 offshore oil and gas tracts in the lower Cook Inlet/Shelikof Strait region. Additional leases may occur in the future, which could potentially increase the borough population.

According to unofficial estimates in 1984, the Kodiak Island Borough is projected to grow from 9,945 in 1980 to 19,556 by the year 2000. Such growth would nearly double the 1980 population figure.

Population Composition

Because of the fishing industry and the military installation in Kodiak, a higher ratio of male-to-female residents has been characteristic. In 1970, the borough population showed a ratio of 57.1% men to 42.9% female. The median age for males was 23.1 years and 21.9 years for females. In the villages the median ages ran much lower.

Kodiak Island has been a cultural melting pot since the Russians first developed the fur industry in the late 1700's. Many Native surnames reflect Scandanavian and Russian ancestry. Although only 20% of the total 1980 borough population was Native, percentages were much higher in the villages.

For example, in 1980 the Larsen Bay community was comprised of 68% Natives, compared to nearly 100% Natives in the Karluk community (Alaska Dept. Comm. and Reg. Affairs, 1981). Table 8 shows the percentage of Natives in each community. Although the borough is predominantly Caucasian, it has a relatively large Koniag and Filipino population. In recent years, the trend has seen a decline in the percentage of Caucasian, Black, and Alaska Natives, while the percentages of other groups, such as Asian and Pacific Islanders, have grown.

Sociocultural Systems

Occupational Orientation

Commercial fishing, a seasonal activity, is the primary occupation of the Kodiak Island Borough residents. Fishing is a major source of income, employment, and food throughout all villages on Kodiak Island. Major salmon, halibut, herring and bottom fisheries provide employment, primarily in the processing industry. Shellfish have been an important industry and include species such as crab, shrimp and scallops. Seafood processing supplied local employment at some of the villages, but with the recent crash in some fisheries no processing facilities are currently in operation.

The city of Kodiak serves as the regional center for employment and commerce.

Table 8. Kodiak Island Borough race characteristics, 1980.

Race	Population Size	% of Total
White	7,110	73
Black	89	1
Filipino	592	6
Korean	88	1
Alaska Natives	1,884	19
-Eskimos	(66)	
-Aleut	(1,701)	
-Indian	(117)	
Total	9,763	100

Source: U.S. Dept. of Commerce, Bureau of Census, 1981.

The salmon harvests provide the most jobs and are the most sought after species by village residents. In 1979, it was estimated that over 73 purse seine permits, 10 beach seine permits and 38 set gill net permits were owned and used by village residents in the Kodiak Islands (Alaska Dept. of Community and Regional Affairs, 1981).

Government workers in state, federal and borough offices, comprise the largest single category of occupations next to total employment at fish processing facilities. Table 9 shows the classes of industry and numbers employed in 1979.

Fishing boats from all parts of the Pacific Northwest and Orient use Kodiak Island as a land base. The fish processing plant may serve several rural communities in Kodiak Island as both a buyer of catches and as a potential employer of residents.

Subsistence Orientation

Subsistence is defined in Title XIII of ANILCA as "the customary and traditional uses by rural Alaskans of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation..." For purposes of discussion, subsistence and local harvests are synonymous and include all hunting, trapping, fishing, and berry gathering done for local consumption by residents of Kodiak Island.

Table 9. Kodiak Island civilian work force, 1979.

Total Civilian Labor Force	Numbers Employed	Private Wage and Salary Workers	Federal Govt. Workers	State Govt. Workers	Local Govt. Workers	Self-empl. Workers	Fishing, Agriculture, Forestry and Mining	Public Admin.	Retail Trade	Professional Svcs.	Educational Services	Manufacture Non-durable Goods*
4707	4365	2,707	376	311	465	489	578	553	605	746	422	912

* Includes fish processing

Source: U.S. Bureau of Census, 1980

Native people have hunted and fished in and around Kodiak Refuge for thousands of years. Until very recently, marine resources have been the most important subsistence fish and game resources used by Kodiak Island residents. Seal, sea lion, salmon, halibut and other marine fish, clams, sea urchins, and other intertidal resources made up most of the subsistence harvest. The introduction of game species early in this century, particularly blacktail deer, have changed hunting patterns and become major food sources for local residents.

Today many island residents living in the vicinity of the refuge depend primarily on commercial fishing for their livelihood and have at least a seasonal cash income. Karluk and Áhkiok resident are generally more dependent on subsistence than other residents on the island because of the absence of industry. Subsistence is important as a way of life for both Native and non-Native residents, although local harvests of resources may not be as economically important to most residents with the establishment of the commercial fisheries. Most residents (including residents of the city of Kodiak) still participate in subsistence activities or use subsistence resources: in a survey conducted by ADF&G and the Kodiak Area Native Association, 100% of the respondents (excluding the Coast Guard sample)

Salmon are one of the most important resources harvested in the refuge for subsistence purposes.

reported using at least some fish and game during the survey year, while over 90% of the households in the six villages reported participating in the harvest of fish and game (ADF&G, 1985).

Community Infrastructure

While the city of Kodiak serves as the regional center for employment and commerce, the village infrastructures are basically developed. The underlying framework and support systems for a given community include its local government, housing, educational facilities, health services, local transportation, water, waste, utilities and communications. In recent years active housing programs have replaced older homes in some of the villages. Table 10 summarizes the existence of facilities and services within each village. The reader should consult the 1981 community profiles prepared by the Alaska Department of Community and Regional Affairs for specific characteristics of community infrastructures.

Of the six rural communities, only Karluk is not a second class city within the Kodiak Island Borough--Karluk remains unincorporated. The other communities have a city council form of government and participate in the State of Alaska's revenue sharing programs. Tribal councils are the official governing body of a village; the regional Native nonprofit tribal organization is the Kodiak Island Area Native Association (KANA).

Economic Conditions

Employment and Income

Table 11 describes major employment and economic opportunities in 1980. The fishing and fish processing industries is the largest employer in the borough. Salmon fishing during summer months is the main industry upon which village residents depend. Most village residents are employed in the fisheries industry, either in the harvest phase as fishermen or in the processing phase as cannery or cold storage workers. The large numbers of transients seeking seasonal work makes such employment competitive. However, the centralization of canneries in the city of Kodiak has lead to decreasing employment opportunities in the villages. The second largest employer is the government. Limited local village employment opportunities are provided by the school, state and Native facilities in the communities. In the future expansion of the bottom fishing industry, expanded timber harvesting, and the start of petroleum exploration and development will contribute to the overall employment and income picture (Kodiak Island Borough Coastal Mgmt. Region, 1983).

Village employment and income are highly seasonal and mainly a by-product of the commercial fishing industry--the six Kodiak Island villages lack stabilized employment opportunities. The seasonal nature of the Kodiak economy is reflected in the variation in labor force size and employment within each year. In 1979, 1,549 people were unemployed in the borough; 512 persons were unemployed for 15 or more weeks. The mean number of weeks of unemployment was 13.2 weeks (U.S. Bureau of Census, 1980).

Table 10. Basic infrastructures of Kodiak Island villages.

Community	Housing Units	Schools		Community Center	Store	Clinic	Post Office	Water	Sewer	Electricity	Local Govt.	Airports	Transportation	
		Elem.	High										Docking	Local Roads
Akhiok	28	X	X	X	X	X	X	X	X	X	2 Class City	X	–	X
Karluk	25	X	X	X	X	X	X	X	X	X	Unincorp. Village	X	–	–
Larsen Bay	49	X	X	X	X	X	X	X	X	X	2 Class City	X	X	X
Old Harbor	93	X	X	X	X	X	X	X	X	X	2 Class City	X	X	X
Ouzinkie	59	X	X	X	X	X	X	X	X	X	2 Class City	Seaplanes Only	X	X
Port Lions	67	X	X	X	X	X	X	X	X	X	2 Class City	X	X	X

Source: Alaska Department of Community and Regional Affairs, 1981.

Table 11. Economic characteristics of Kodiak Island communities, 1980.

Village	Cash Income Commercial Fishing	Subsistence Non-Wage	Seasonal Employment	Fish Processing*	Description
Akhiok	Major	Major Fishing	Major Summer	No	Main economic activity in both commercial and subsistence fishing. Reindeer herding non-operative. Limited jobs in village, but mainly seasonal. School system employs 2 permanent positions and 6 part-time; Kodiak Area Native Association Community Health program is the main employer.
Karluk	Major	Major Fishing	Major Summer	No	Commercial and subsistence fishing. Twenty percent of population unemployed; sixteen percent year-round labor force; 64% seasonally employed. Once known as greatest salmon stream in world when a large cannery was operating in late 1800's.
Larsen Bay	Major	Major Fishing	Major Summer	Yes	Local cannery employs ten villagers. Commercial and subsistence fishing main industry. School Tribal Government, Regional Corp., city, and school employed several more positions in 1978-80. Only 11.5% of the population fully employed.
Old Harbor	Major	Major Fishing	Major Summer	No	Salmon fishing industry and employment in seafood processing plants in Kodiak and on floating processors major industry. In 1979, only 7% of work force had year-round employment.
Ouzinkie	Major	Major Fishing	Major Summer	Burned in 1976	Commercial fishing main industry. Nine percent year-round employment. Grocery store, clinc, and schools provide wage employment.
Port Lions	Major	Major Fishing	Major Summer	Burned in 1974	Commercial and subsistence fishing are major source of income, employment and food. Seafood processing has been active until King Crab crash. Bottom-fishing is new industry. School, cafe, stove, lodge, boat harbor and a few others provide wage employment. Nearly 16% year-round employment in 1981.

*Bottom fishing industry is expected to expand in current decade.

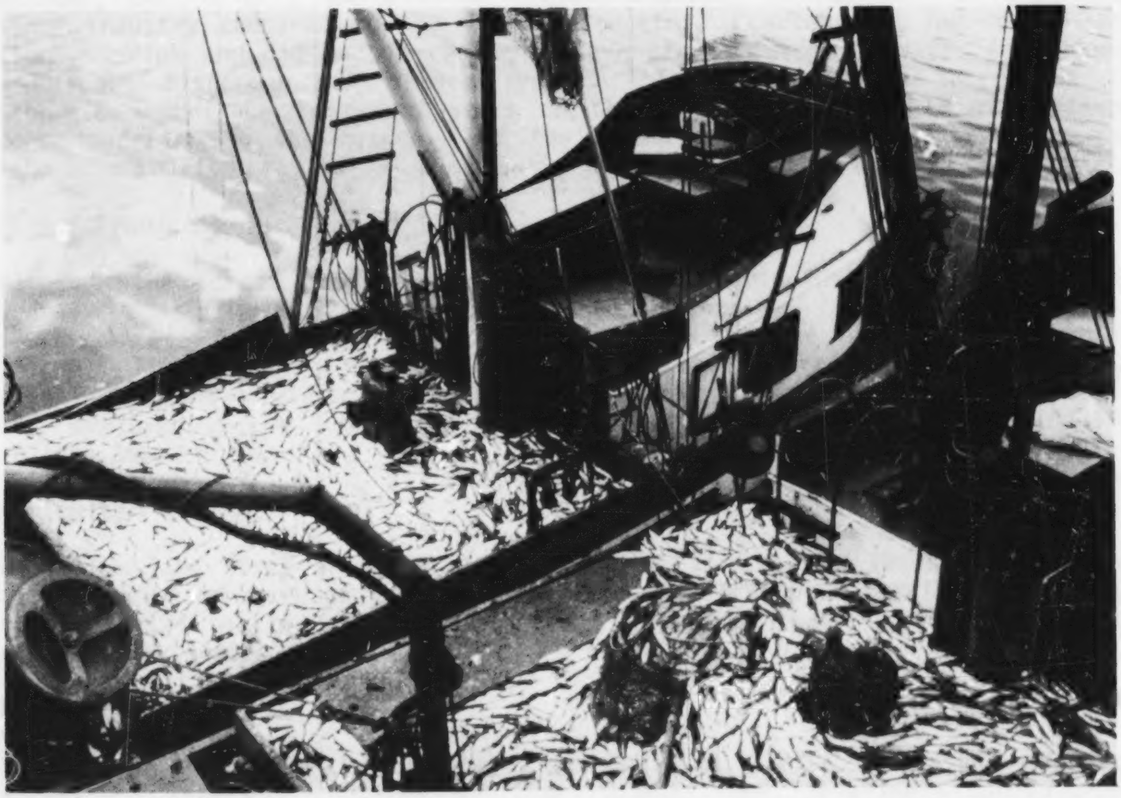
Source: Alaska Department of Community and Regional Affairs, 1981.

In 1980, both the labor force and the number of employed persons increased over 50% from March to July. Unemployment rates in the borough in 1980 varied from 13% in March to 5% in August (Alaska Dept. Labor, Statistical Quarterly, 1980). (For more information on employment and income characteristics see the Kodiak Island Borough Coastal Management Program concept approved draft, 1983.)

Commercial Fishing

The Kodiak Island borough economy is based primarily on the harvesting and processing of seafood. The outlying village economies are based on a combination of commercial seafood industry activities and subsistence. The city of Kodiak economy is based on the seafood industry, but is somewhat more diversified (Kodiak Island Borough, 1983).

Table 12 shows the value of Kodiak area salmon fishing to processors in 1981. The 1980 salmon harvest was the largest in the past 30 years, when a total of 67.8 million pounds of salmon (31.7 million kg) were caught. The Kodiak Refuge is the major location of spawning streams for salmon runs.



The Kodiak Island economy is based primarily on the harvesting and processing of seafood.

Table 12. Fishery production and wholesale values for Alaska's western region, 1981.

Region & Area	Salmon		Other Fin Fish		Shellfish		Grand Total	
	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value
Western								
- Kodiak	67,806	118,773	15,774	21,596	29,130	107,837	112,710	248,207
-Chignik	10,889	22,221	297	297	1,389	3,066	12,575	25,567
-Alaska Peninsula	41,450	79,895	1,605	1,335	6,468	18,381	49,523	99,611
-Dutch Harbor	6,218	12,804	2,952	1,731	49,112	124,576	58,282	139,111
-Bering Sea	N/A	N/A	6,755	6,741	22,241	72,229	28,996	78,970
-Adak & W. Aleutians	97	120	136	20	2,071	5,803	2,304	5,943
Region Total	126,460	233,814	27,520	31,703	110,411	331,892	264,391	597,409
State Total	413,037	$779,560	93,538	$81,977	125,141	$380,165	$631,717	$1,241,702

[a] Pounds and dollar values are in thousands.

Source: Alaska Department of Community and Regional Affairs, 1981.

Constraints on the fish processing industry include the availability of low-cost energy, processing waste disposal sites, and adequate supplies of water. Borough energy costs for freezing and frozen storage are high, but with the completion of the Terror Lake hydroelectric project, electricity prices are no longer totally tied to increasing cost of diesel fuel (AEIDC, 1980).

Although the shellfish industry has been hit hard by the closure on king crab harvests, recent investments have been made in the bottomfishing processing industry. Nine bottomfishing canneries are expected to activate within the next two years. Crab fishermen are investing in new gear for the conversion to bottomfishing. The Kodiak Island based bottomfishing industry is expected to significantly increase its production over the next ten years. The addition of bottomfish catches to traditional salmon, halibut, and herring processing activities will help make the Kodiak seafood processing industry a diversified, year-round operation.

Tourism/Recreation Industry

For many years tourism has been a source of income to the Kodiak Island economy, particularly the city of Kodiak, although it has been a relatively minor industry compared to the fishing industry. Larsen Bay, Ouzinkie, Port Lions, Karluk and Old Harbor residents have provided some services to hunters and sport fishermen for several years. Tourism has been increasing in economic importance in recent years on the island, and probably will become more important in the future. If the commercial fishing industry does not rebound, tourism may play a much larger role in the economy of Kodiak.

Forest Products

Although the forest products industry has been periodically active for many years, it is a minor segment of the Kodiak economy. Sitka spruce forest resources are located on the northern islands and the north end of Kodiak Island. Timber quality is not high because trees are relatively short with a high production of less desirable, knotty limber. An average of 306 people were employed by the lumber and wood products industry in the borough in 1980 (Alaska Dept. of Labor).

Agriculture

While Russians first brought cattle to Kodiak Island, the industry has never flourished. Due to high transportation costs and the poor nutritional quality of Kodiak's native grasses, the cattle industry will probably remain economically unattractive.

Minerals

Exploration for minerals has been sporadic and limited to areas of easy access. Interior portions of the islands are relatively unexplored. Historically, gold has been the main commodity found in the borough, which involved small scale placer operations. No commercial scale mining activities are present, nor are there any mining claims. All refuge lands are closed to mineral entry.

Petroleum exploration and development could contribute to the borough's economy, although benefits from local employment and related expenditures are not expected to be large (Kodiak Island Borough, 1983).

Public Uses

An estimated 16,400 visitors participated in 106,000 hours of public use on the refuge and at the visitor center in calendar year 1984 (Table 13). Nearly half the visits to the refuge and 85% of the public use activity hours involved hunting, fishing, and other consumptive recreation. In 1984, the five most popular uses of the refuge based on activity hours were: 1) deer hunting (35%); 2) fishing (26%); 3) bear hunting (10%); 4) trapping; (5%); and 5) berry picking and other consumptive use (4%). It should be noted that the number of activity hours varies widely for different categories of public use. For example, visitor center users average only one-half hour per visit while each deer hunter spends about 48 hours hunting per visit to the refuge). Nonconsumptive recreation, interpretation, and environmental education accounted for 9.0, 5.6, and 0.2 percent of refuge public use, respectively. Nonconsumptive recreation appears to be increasing more rapidly than consumptive recreation, although the numbers are expected to remain relatively small in the near future.

Deer hunting is a leading recreational use of Kodiak Refuge.

Table 13. Public use visits and activity hours on Kodiak Refuge, 1984.[a]

Activity	Visits[b]	Percentage of Total	Activity Hours	Percentage of Total
Interpretation				
Visitor Center	2,200	14	1,300	1
Exhibits	500	3	300	<1
Interpretive Programs	2,800	17	4,200	4
Subtotal	5,500	34%	5,800	6%
Environmental Education	300	2	200	<1
Consumptive Recreation				
Waterfowl Hunting	400	2	2,000	2
Upland Game Hunting	400	2	1,600	1
Deer Hunting	1,400	9	37,000	35
Bear Hunting	200	1	10,900	10
Small Game Hunting	300	2	1,400	1
Mountain Goat Hunting	40	<1	900	<1
Trapping	500	3	4,900	5
Fishing	4,000	25	27,500	26
Berry Picking, etc.	900	6	4,300	4
Subtotal	8,140	50	90,500	84
Nonconsumptive Recreation				
Camping	40	<1	900	<1
Hiking	900	6	3,700	3
Boating	900	6	2,500	2
Photography	200	1	1,600	2
Other Use	400	2	1,000	1
Subtotal	2,520	15	9,700	9
Total Public Use	16,160	100	106,200	100

---

[a] Visits and activity hours are approximate. One activity hour is equal to one person involved in the specified activity for one hour.

[b] People participating in two or more activities during a "visit" are counted more than once in the above table. For consumptive and nonconsumptive recreational uses of the refuge, approximately one-third of the visits are estimated to be a second or third activity by a person primarily engaged in another recreational use.

Source: Kodiak Refuge files

Access and Transportation

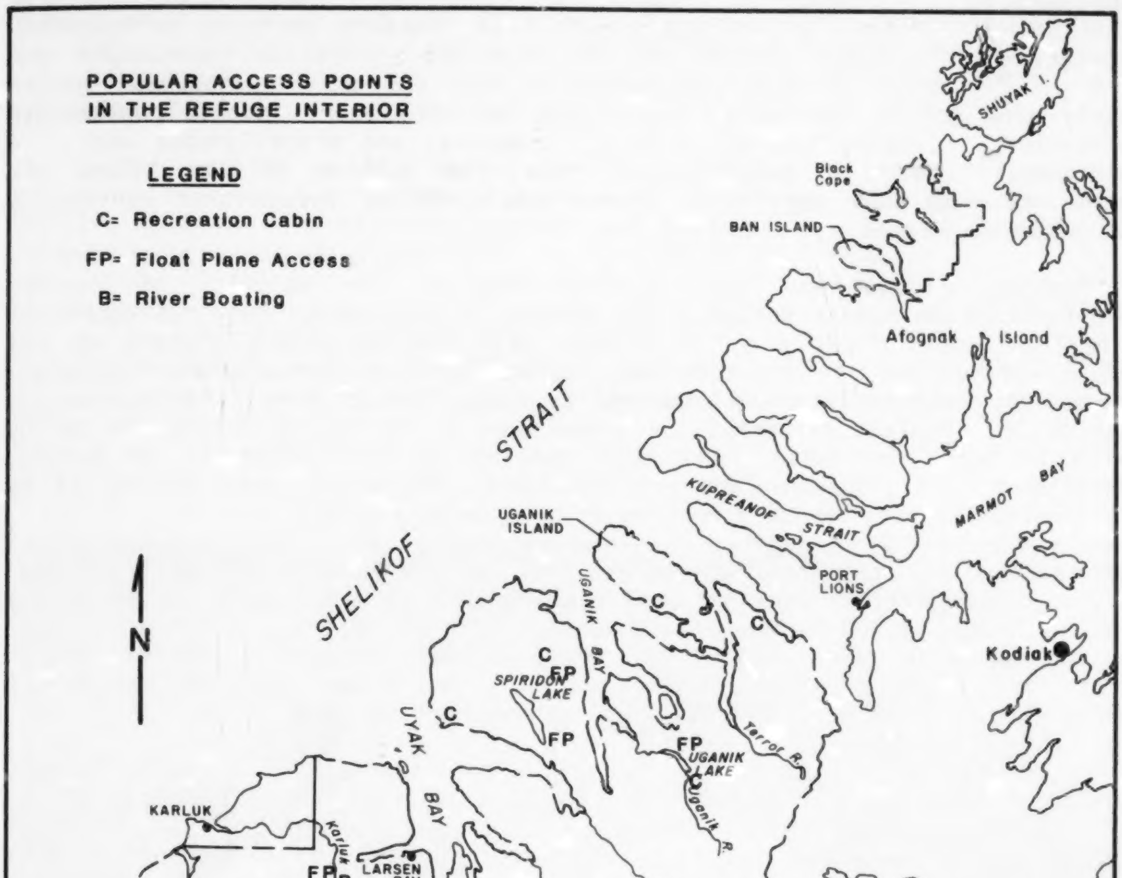
Figure 27 indicates the locations of interior and coastal recreation cabins, lakes accessible by float plane, and rivers suitable for floating with a small boat. Boats and fixed-wing aircraft are the primary means of access to the refuge; no roads or maintained trails provide access to or within the refuge.

Residents of the city of Kodiak and villages around the island often use boats for access to hunting areas along coastal portions of the refuge. Small float planes are used by guided hunting and fishing groups and most unguided recreationists to get to interior lakes. These planes also may be used as a means of transportation to sheltered coastal areas. No landing strips are located on the refuge, except at village sites. Some fishermen use small boats (mostly inflatables) and motors for transportation on lakes, bays, and larger streams.

Land-based recreational vehicles including wheeled vehicles, hovercraft, and other off-road vehicles (ORVs) are not permitted on the refuge. Access by helicopter is restricted to special use permit holders and is not permitted for recreational access. Recreational use of jet boats and air boats is not permitted on refuge waters.

Floatplanes are the primary means of access to Kodiak Refuge.

Figure 27. Popular access points and recreational cabins in Kodiak Refuge.


POPULAR ACCESS POINTS IN THE REFUGE INTERIOR
LEGEND
C= Recreation Cabin
FP= Float Plane Access
B= River Boating
SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
N
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Terror R.
Uganik R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
UGAK BAY
KARLUK LAKE
Middle Cape
Ayakulik R.
RED LAKE
FRAZER LAKE
KILIUDA BAY
OLD HARBOR
Dog Salmon Creek
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0 10
MILES

Projected Changes - No major changes in access to the refuge are expected.

Recreation

Nearly nine out of ten refuge public use activity hours involve consumptive recreation, including hunting, fishing, trapping, and miscellaneous uses. A substantial number of refuge users come from outside of the island and out-of-state to hunt and fish. Approximately 40% of refuge bear hunters do not reside in Alaska.

Hunting - Deer and bear hunting comprise the majority of hunting opportunities on Kodiak Refuge. All hunting on the refuge requires access by a boat or small float plane. Fifteen bear hunting guides operate on the refuge, providing guide services, primarily for non-Alaskan hunters--nonresident bear hunters are required by state law to hire a registered big game guide. Hunters harvested 131 brown bear on the refuge during the spring and fall hunts in 1984. All bear hunting on the refuge is by permit. Nonresident (i.e., hunters who are not Alaska residents) bear hunting is by registration permit; resident hunting is by drawing permit.

Deer hunting is the leading recreational use of Kodiak Refuge. Liberal harvest quotas attract many nonlocal deer hunters to participate in the Kodiak hunt. Nearly 1,400 hunters used the refuge during the fall/winter deer hunting season in 1984. Due to the remoteness and substantial cost of gaining access to the refuge, small game, waterfowl, and upland game hunting on the refuge are primarily incidental to other hunting activities.

Sport Fishing - Sport fishing for five species of Pacific salmon, steelhead, Dolly Varden, and rainbow trout attracts many recreationists to the refuge. Eleven sport fishing guides operated on the refuge in 1984, although only one has permanent facilities located on the refuge proper. Many fishermen participate in a variety of recreation activities including wildlife observation and photography while on the refuge. Summer use of the refuge's nine recreation cabins is primarily for sport fishing.

Many nonlocal and out-of-state resident sport fishermen use the refuge because of Kodiak's reputation as an angler's paradise.

Other Wildlife-Related Activities - The majority of visitors from off the island come to Kodiak Refuge to fish or hunt. Nonconsumptive activities, such as hiking, wildlife observation, and beach combing may occur, but are often ancillary to these activities. Nonconsumptive uses, including photography and hiking, have increased in recent years.

Projected Changes - Increases in most refuge public use activities are expected as Kodiak Island's population increases and recreational opportunities on the refuge become more widely known. No major changes in the type or location of refuge recreational opportunities are anticipated. The overall increase in refuge public use is estimated to be about 10% per year in the foreseeable future. Consumptive recreational uses of the refuge, including hunting, fishing, trapping, berry picking, and clamming, are expected to increase gradually. If recent trends continue, photography and wildlife observation will grow even more rapidly throughout the next 10 to 20 years. Significant increases in refuge environmental education and interpretive programs probably will take place in the future. Interpretive and educational activities are based at the visitor center, located at the refuge headquarters near the town of Kodiak and about 21 miles (34 km) from the refuge boundary.

The recent opening of the visitor center, addition of a public use staff position, improved publications, and use of volunteers will make the refuge and its programs increasingly visible and available to local residents and island visitors in coming years.

Subsistence

The information contained in this section was used in the Section 810(a) evaluations that were done for each of the management alternatives in Chapter VII.

Photography and wildlife observation are expected to grow rapidly over the next 10 to 20 years.

Subsistence uses are defined in ANILCA as the customary and traditional uses by rural Alaska residents of wild, renewable resources for personal or family consumption. This means that all harvests of refuge resources by local residents qualifies as subsistence use. For the purposes of this plan, all local harvests will be considered to be subsistence. To be consistent with the State Boards of Fish and Game, which have not yet made specific determinations of what constitutes subsistence uses in this area, the text generally will refer to local harvests rather than to subsistence.

The information presented here was taken primarily from ADF&G's Habitat management guide, southwest region (1985), which in turn was based on a survey conducted by the Kodiak Area Native Association and ADF&G from May, 1982 through June, 1983. Because data are available for only a single 12-month period, caution should be exercised in interpreting quantitative data--harvests often vary significantly from year to year.

Residents of Kodiak Island harvest at least 17 species of fish, 15 species of game, 15 species of marine invertebrates, and 30 plant species. A substantial number and quantity of fish and game are harvested by local residents:

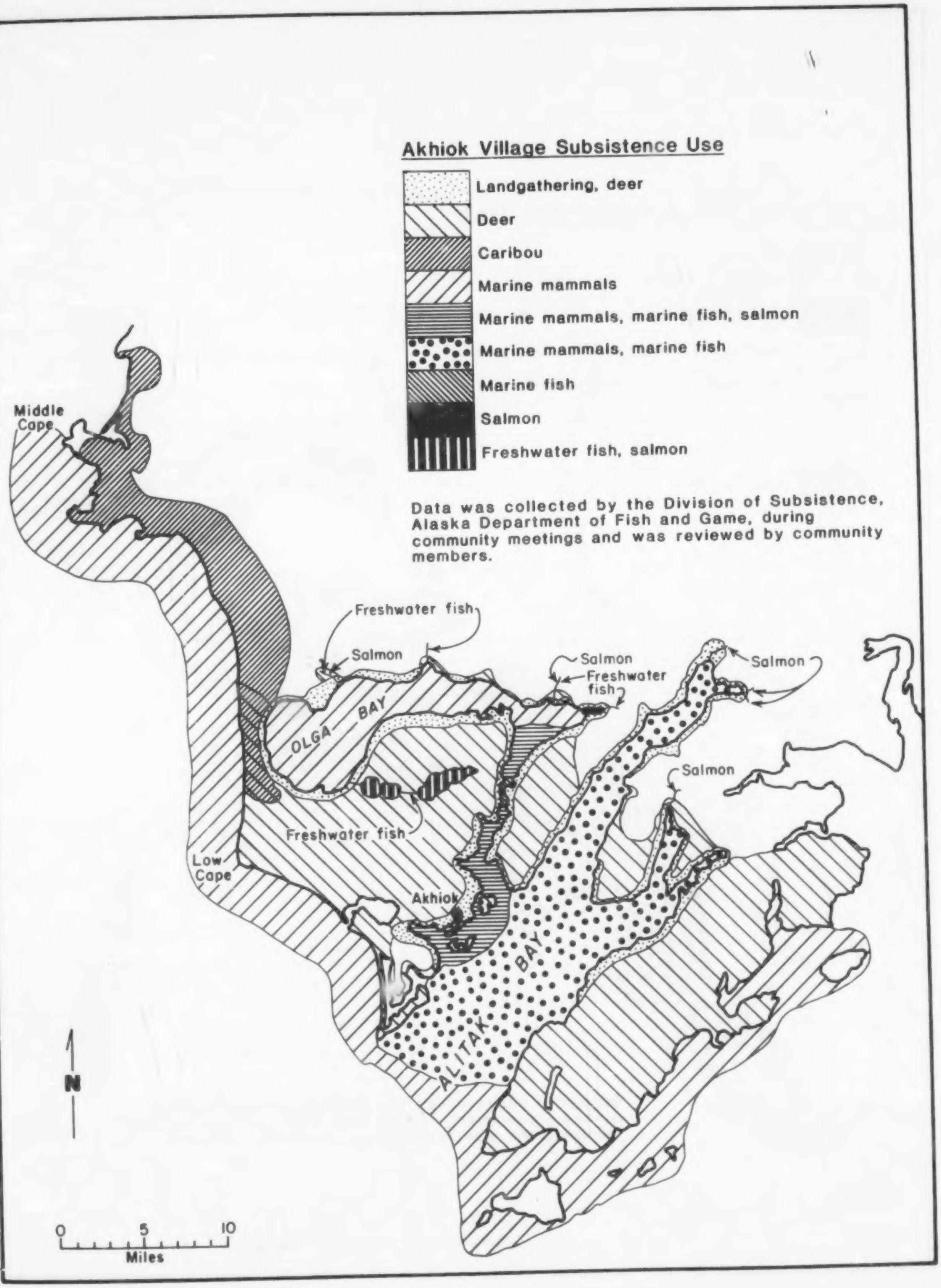
- In 1982-1983, Kodiak residents harvested an estimated 182,000 salmon, 21,000 halibut, 36,500 king crabs, 6,600 deer, and 14,900 ducks for noncommercial use.
- An average of about 435 pounds (200 kg) of wild foods was harvested per person in the six island villages (Akhiok, Karluk, Larsen Bay, Old Harbor, Ouzinkie, and Port Lyons) in 1982-1983.
- The six villages reported a household average harvest of about 170 salmon, 4.3 deer, and 24 ducks per year.

Salmon and deer are probably the most important resources harvested on the refuge. Other refuge resources that may be harvested by local residents include Dolly Varden/Arctic char, steelhead/rainbow trout, brown bear, reindeer, elk, goat, hare, ptarmigan, ducks, geese, fox, weasel, land otter, beaver, and bird eggs. It is important to note that many of these species are also harvested outside of the refuge boundary, and that no marine resources (one of the most important subsistence resource categories) are harvested within the refuge boundary.

Different resources are harvested by residents of the four villages within the refuge boundary at different times of the year, as indicated by seasonal round data collected by ADF&G (1985). Salmon are harvested primarily from May through December, depending on when the runs occur. Dolly Varden, another fish species highly utilized by local residents, are caught year-round. Deer are also probably harvested year-round. Waterfowl, ptarmigan and hare are generally hunted from September through May.

Figures 28-33 show generally where local residents from the six villages on Kodiak Island harvested resources in 1983; other areas also may be used. Figures 34-35 show where local residents harvest salmon and deer in or near the refuge. The figures do not show where waterfowl are harvested. Most resources, including waterfowl, are harvested near the village sites and along the coast--the refuge interior receives little use compared to the coast.

Figure 28. General areas where Akhiok residents harvest resources.


Akhiok Village Subsistence Use
Landgathering, deer
Deer
Caribou
Marine mammals
Marine mammals, marine fish, salmon
Marine mammals, marine fish
Marine fish
Salmon
Freshwater fish, salmon
Middle Cape
Freshwater fish
Salmon
OLGA BAY
Salmon
Freshwater fish
Salmon
Salmon
Freshwater fish
Low Cape
Akhiok
ALITAK BAY
N
0
5
10
Miles

Data was collected by the Division of Subsistence, Alaska Department of Fish and Game, during community meetings and was reviewed by community members.

Figure 29. General areas where Old Harbor residents harvest resources.

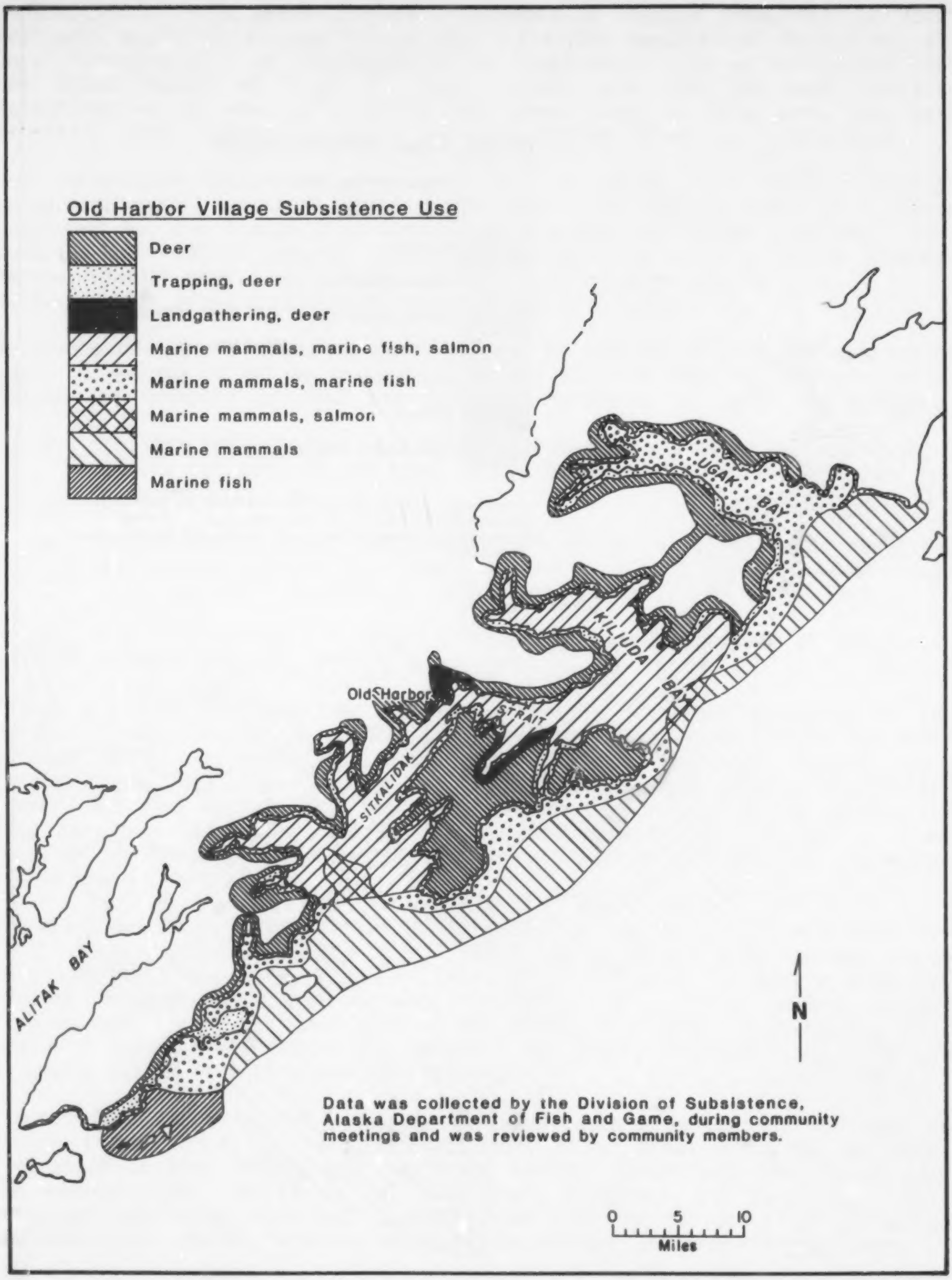

Old Harbor Village Subsistence Use
Deer
Trapping, deer
Landgathering, deer
Marine mammals, marine fish, salmon
Marine mammals, marine fish
Marine mammals, salmon
Marine mammals
Marine fish
UGAK BAY
KILIUDA BAY
Old Harbor
STRAIT
SITKALIDAK
ALITAK BAY
N
Data was collected by the Division of Subsistence, Alaska Department of Fish and Game, during community meetings and was reviewed by community members.
0
5
10
Miles

Figure 30. General areas where Karluk residents harvest resources.

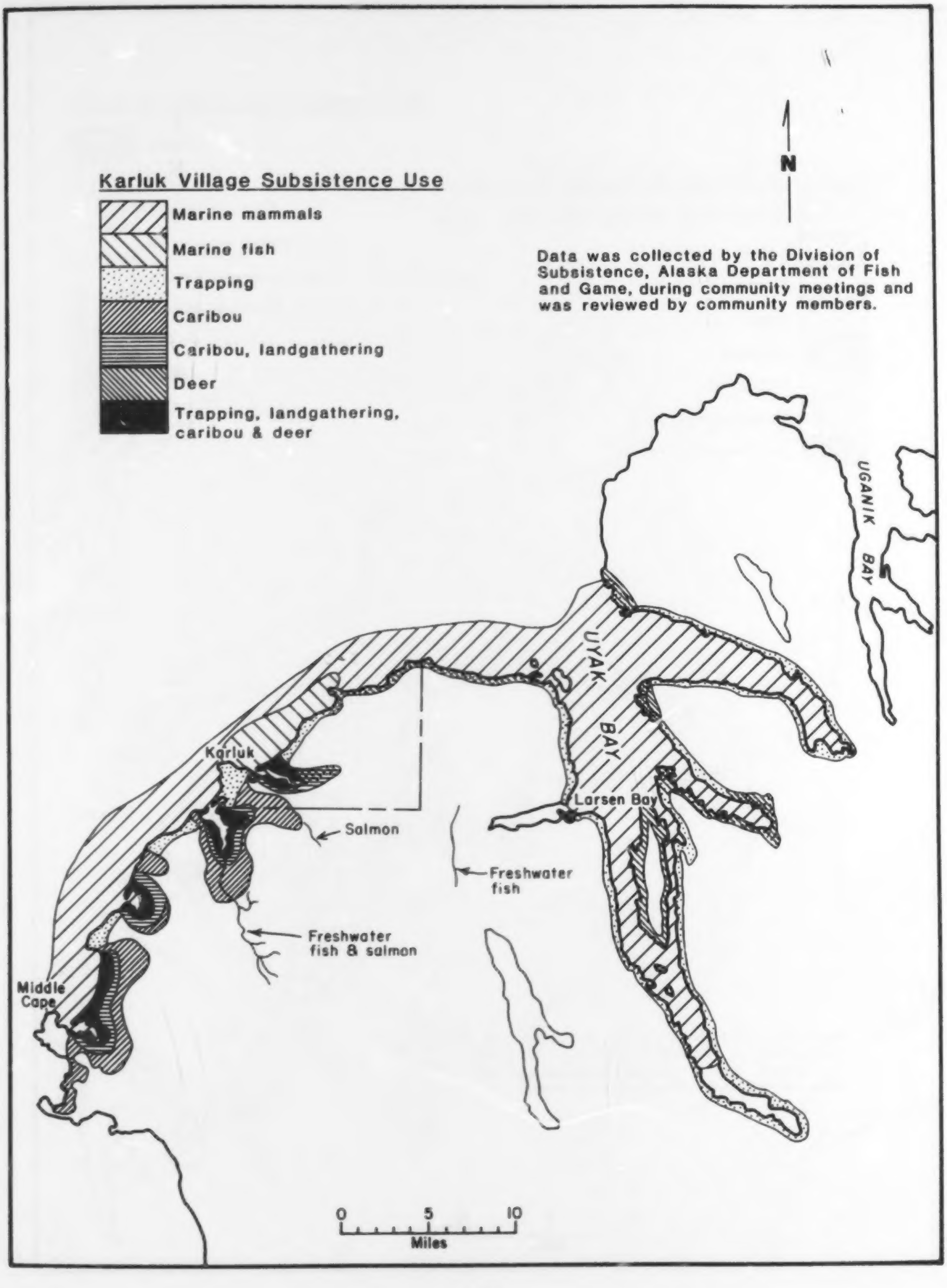

Karluk Village Subsistence Use
Marine mammals
Marine fish
Trapping
Caribou
Caribou, landgathering
Deer
Trapping, landgathering, caribou & deer
N
Data was collected by the Division of Subsistence, Alaska Department of Fish and Game, during community meetings and was reviewed by community members.
UGANIK BAY
UYAK BAY
Karluk
Larsen Bay
Salmon
Freshwater fish
Freshwater fish & salmon
Middle Cape
0
5
10
Miles

Figure 31. General areas where Larsen Bay residents harvest resources.

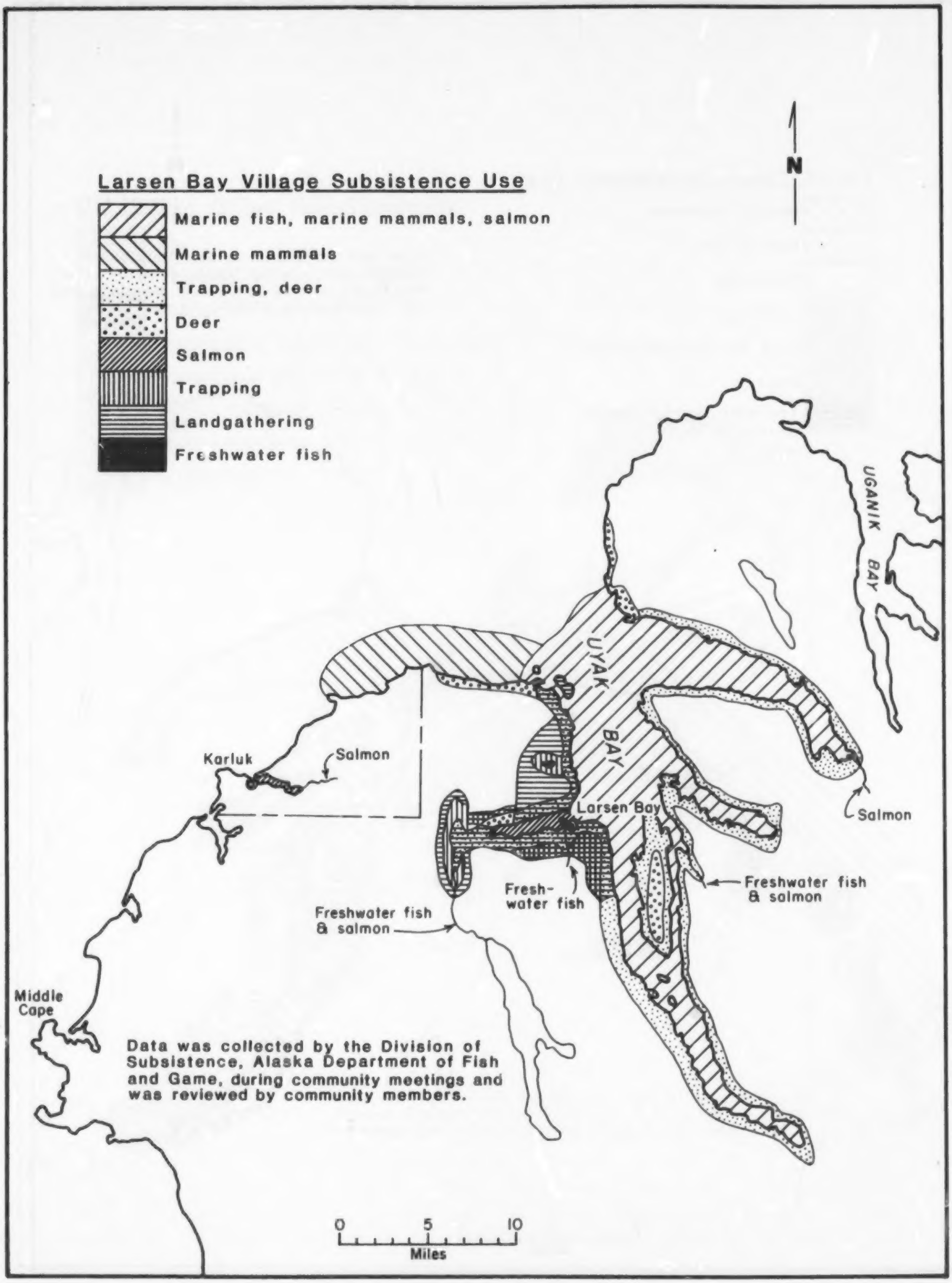

N
Larsen Bay Village Subsistence Use
Marine fish, marine mammals, salmon
Marine mammals
Trapping, deer
Deer
Salmon
Trapping
Landgathering
Freshwater fish
UGANIK BAY
UYAK BAY
Karluk
Salmon
Larsen Bay
Salmon
Freshwater fish & salmon
Fresh-water fish
Freshwater fish & salmon
Middle Cape
Data was collected by the Division of Subsistence, Alaska Department of Fish and Game, during community meetings and was reviewed by community members.
0
5
10
Miles

Figure 32. General areas where Ouzinkie residents harvest resources.

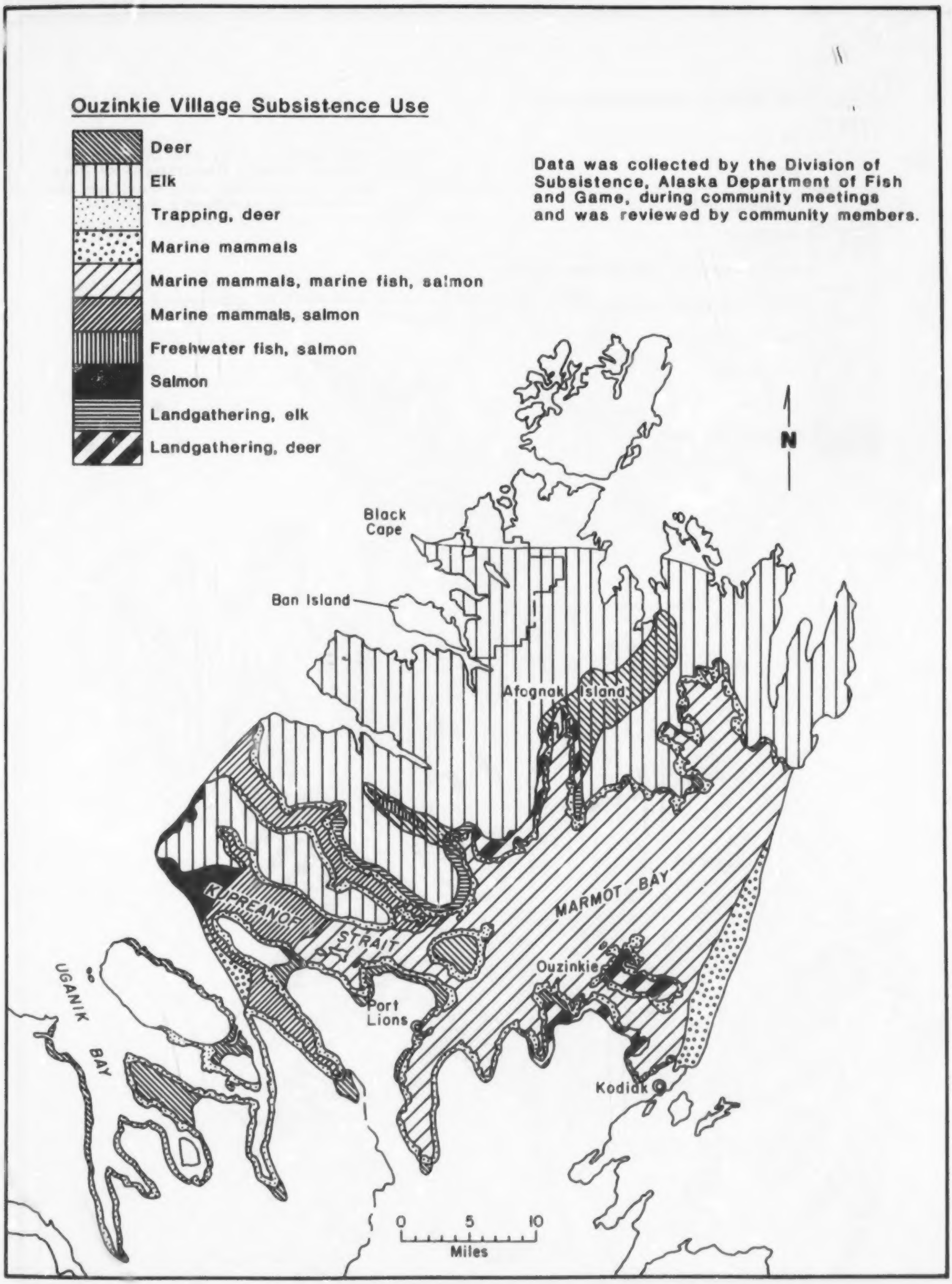
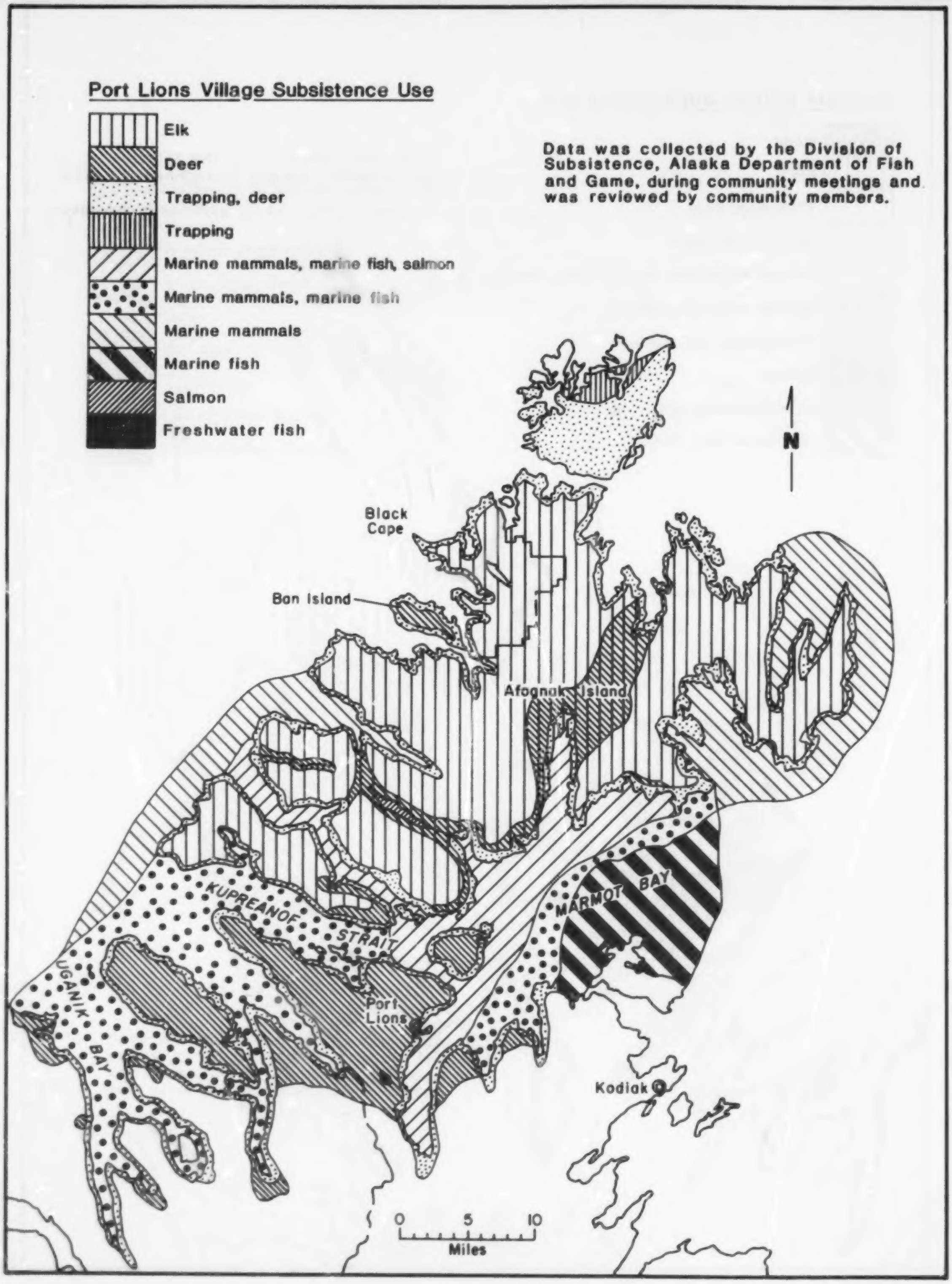

Ouzinkie Village Subsistence Use
Deer
Elk
Trapping, deer
Marine mammals
Marine mammals, marine fish, salmon
Marine mammals, salmon
Freshwater fish, salmon
Salmon
Landgathering, elk
Landgathering, deer
Data was collected by the Division of Subsistence, Alaska Department of Fish and Game, during community meetings and was reviewed by community members.
N
Black Cape
Ban Island
Afognak Island
KUPREANOF STRAIT
MARMOT BAY
UGANIK BAY
Ouzinkie
Port Lions
Kodiak
0 5 10
Miles

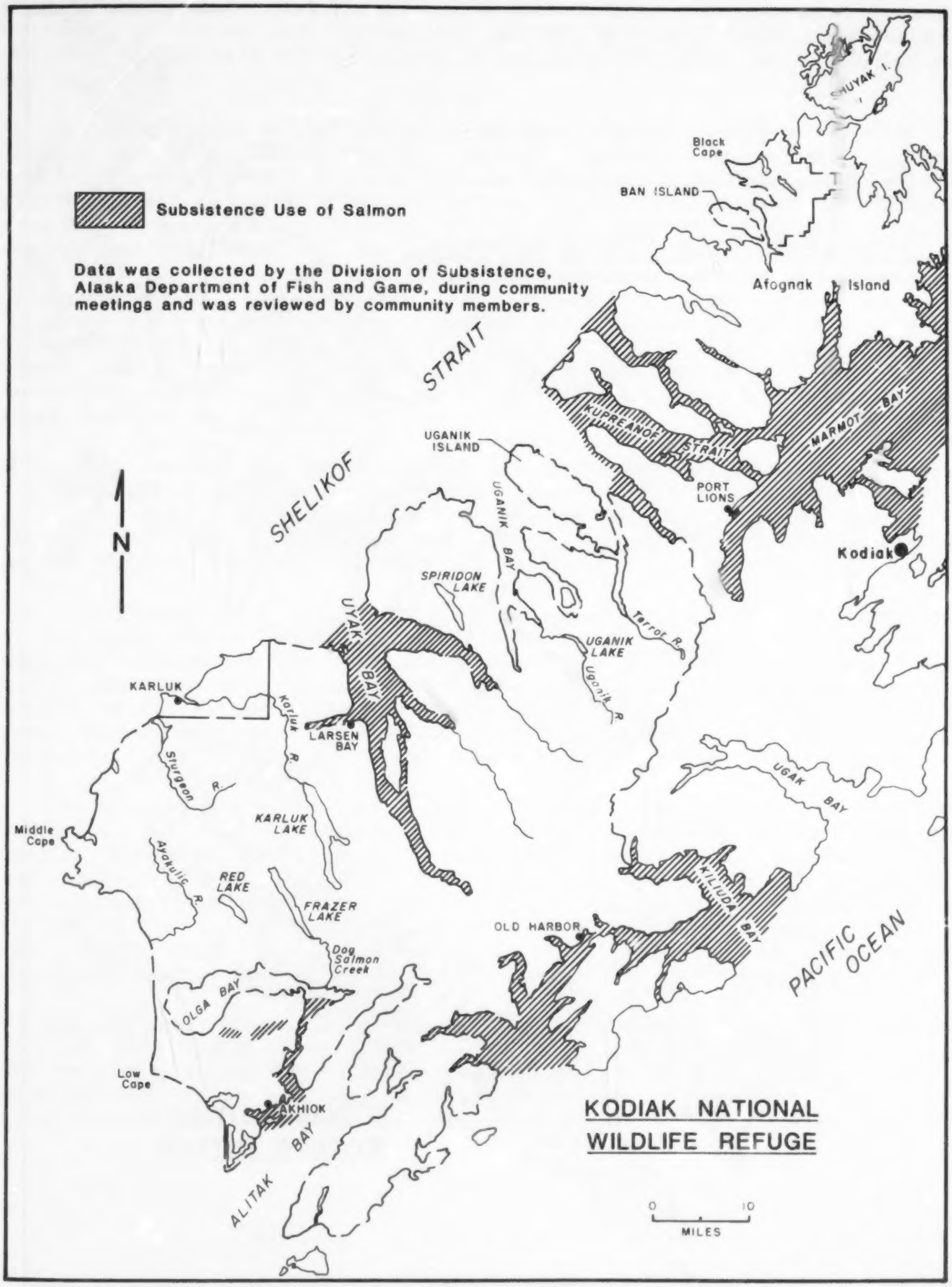
Figure 33. General areas where Port Lions residents harvest resources.



Port Lions Village Subsistence Use
Elk
Deer
Trapping, deer
Trapping
Marine mammals, marine fish, salmon
Marine mammals, marine fish
Marine mammals
Marine fish
Salmon
Freshwater fish
N
Black Cape
Ban Island
Afognak Island
KUPREANOF STRAIT
MARMOT BAY
UGANIK BAY
Port Lions
Kodiak
0 5 10
Miles

Data was collected by the Division of Subsistence, Alaska Department of Fish and Game, during community meetings and was reviewed by community members.

Figure 34. General areas where local residents harvest salmon in the Kodiak Refuge area.



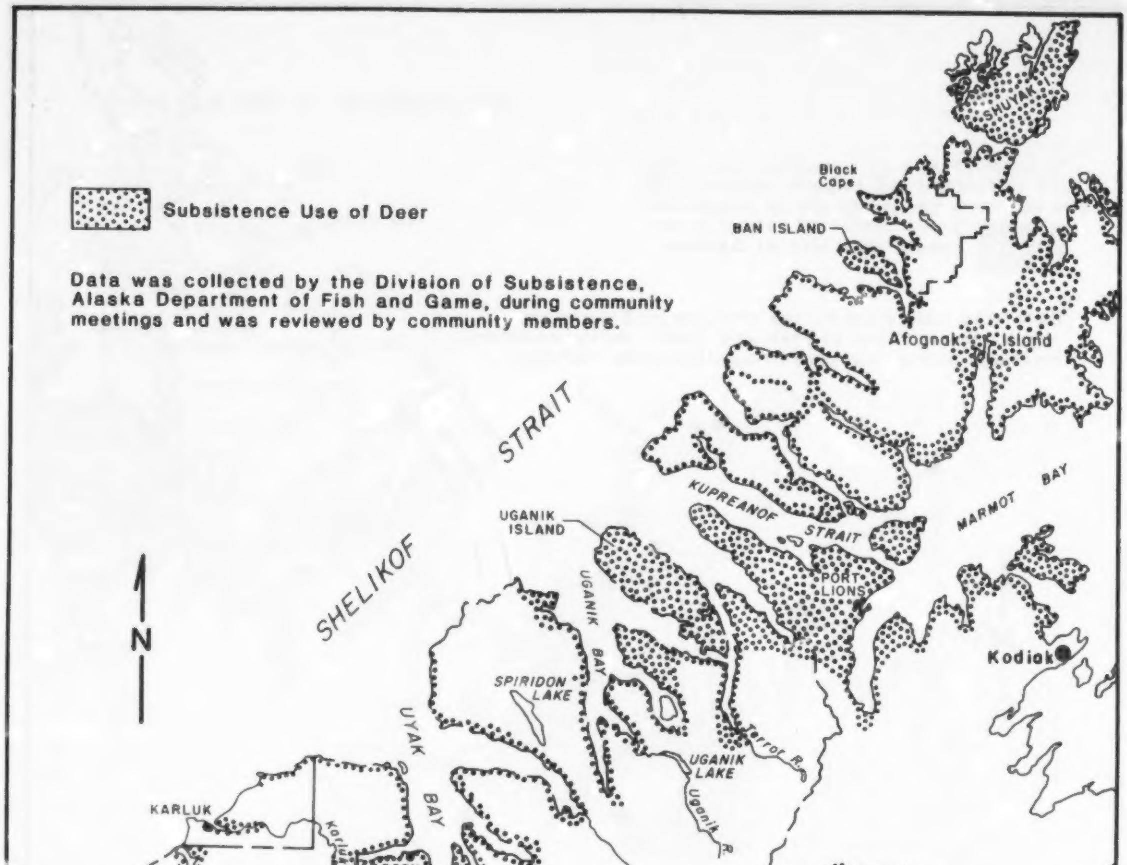
▨ Subsistence Use of Salmon

Data was collected by the Division of Subsistence, Alaska Department of Fish and Game, during community meetings and was reviewed by community members.

KODIAK NATIONAL WILDLIFE REFUGE

SHUYAK I.
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF STRAIT
MARMOT BAY
UGANIK ISLAND
PORT LIONS
Kodiak
N
UGANIK BAY
SPIRIDON LAKE
UYAK BAY
UGANIK LAKE
Uganik R.
Terror R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
Middle Cape
KARLUK LAKE
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
UGAK BAY
KILIUDA BAY
OLD HARBOR
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
0
10
MILES

Figure 35. General areas where local residents harvest deer in the Kodiak Refuge area.


Subsistence Use of Deer
SHUYAK
Black Cape
BAN ISLAND
Afognak Island
STRAIT
SHELIKOF
KUPREANOF
STRAIT
MARMOT BAY
UGANIK ISLAND
UGANIK BAY
PORT LIONS
Kodiak
N
SPIRIDON LAKE
UYAK BAY
Terror R.
UGANIK LAKE
Uganik R.
KARLUK
Karluk R.
LARSEN BAY
Sturgeon R.
Middle Cape
KARLUK LAKE
Ayakulik R.
RED LAKE
FRAZER LAKE
Dog Salmon Creek
UGAK BAY
KILIUDA BAY
OLD HARBOR
PACIFIC OCEAN
OLGA BAY
Low Cape
AKHIOK
ALITAK BAY
KODIAK NATIONAL WILDLIFE REFUGE
0
10
MILES

Data was collected by the Division of Subsistence, Alaska Department of Fish and Game, during community meetings and was reviewed by community members.

Most of the resources harvested on the coast, such as marine resources, are not harvested within the refuge boundary. There is some overlap in the areas used by residents of Akhiok and Old Harbor on the southwest coast, between residents of Karluk and Larsen Bay on the northwest coast, and between residents of Ouzinkie and Port Lions on the northwest coast and on Afognak and Ban islands.

Akhiok - Almost all of Akhiok's residents depend heavily on fishing and hunting for various food sources, including salmon, crab, shrimp, scallop, clam, seal, deer, rabbit and bear (Alaska Department of Community and Regional Affairs, 1981). Akhiok residents use the coastal and adjacent inland areas from Kiavik Bay to Cape Trinity, all of the coastline of Alitak, Portage, Deadman and Olga bays, and the coastal and inland areas from Cape Alitak to Cape Grant for the harvest of fish and game resources for local consumption. Twoheaded Island, Geese Islands, and th Aiatalik Island group are also important for resource harvests. Tugidak and Sitkinak islands were used for resource harvesting in historic times, but little use has taken place in recent years. Additional coastal areas may be used incidentally for resource harvesting when Akhiok residents are traveling by boat to other communities or commercial fishing.

Within the refuge, deer and waterfowl are hunted inland and on beach areas. Anadromous fish species are harvested in coastal areas. Coastal habitats outside of the refuge boundary are of particular importance for the harvest of seal and sea lion, hunted along rocky shores, and of clams, crabs, and other marine invertebrates, many of which are harvested from the intertidal zone.

The area bounded by a line crossing Alitak Bay from Cape Alitak to Humpy Cove to the south and a line drawn north from Stockhom Point at the entrance to Olga Bay encompasses the area intensively used by Akhiok residents. Most salmon and deer are harvested in this area, as well as marine resources outside of the refuge. The other identified coastal area are also regularly used, particularly for the harvest of seal and sea lion and for salmon harvesting when fishing in areas closer to the village site is poor.

Karluk - In the village of Karluk, fishing is the primary livelihood for residents, but nearly all depend on fishing and hunting as food sources. Species harvested include salmon, steelhead/rainbow trout, flounder, duck, seal, deer, reindeer, rabbit and ptarmigan. Karluk residents use the coastal and adjacent inland areas from Inner Seal Rock near Gurney Bay to the mouth of the Karluk River, from the Karluk River mouth to Harvester Island, and all of the coastal areas of Uyak and Spiridon bays, extending to Cape Kuliuk. Additional coastal areas south of Gurney Bay may have been used historically.

Village residents harvest waterfowl and deer within the refuge. Seal and sea lion are also hunted on the coast. The coastal areas facing Shelikof Strait are frequently stormy and have few good moorages. Karluk residents frequently hunt and fish in the less exposed areas of Uyak and Spiridon Bays. Very close relationships exist between the residents of Karluk and Larsen Bay.

Larsen Bay - Although the economy of Larsen Bay is primarily dependent on cannery and fishing work, a large majority of the population depends on fishing and hunting for food sources. Species harvested include seal, sea lion, salmon, halibut, codfish, ducks, clams, sea urchins, crab, deer, and berries. Larsen Bay residents use the coastal and adjacent inland areas from the mouth of the Karluk River to Harvester Island, as well as that of Uyak Bay, Larsen Bay, and Spiridon Bay extending to Cape Kuliuk to the north. Within the refuge boundary the Uyak and Spiridon Bays coastal areas are used intensively for hunting deer and waterfowl and for fishing; seal, sea lion and other marine resources are also harvested intensively here. The coastal area between Harvester Island and Karluk River is used during frequent trips made by Larsen Bay residents to Karluk.

Old Harbor - While many of Old Harbor's residents are commercial fishermen, most hunt and fish for certain species including: halibut, crab, herring, salmon, duck, seal, deer, rabbit, bear, and berries. Residents of this community use the coastal and adjacent inland areas from Narrow Cape in the northeast to Geese Channel in the southwest. Within or near the refuge, local residents use the coastal areas of Ugak Bay, Sitkalidak Strait, Kaiugnak Bay, and Kaguyak Bay. Sitkalidak Island, Twoheaded Island, and the Geese Islands are also used to harvest resources. Coho, pink and chum salmon, deer, and waterfowl are all harvested within the refuge. These species, and halibut, crab, seal, and sea lion, account for the greatest part of the fish and game harvested by Old Harbor residents in the above areas.

Other communities - Residents of Ouzinkie and Port Lions fish and hunt the coastlines, bays and adjacent inland areas of a large portion of north and northwest Kodiak Island (including the refuge) and of the southern half of Afognak Island. Areas bounded by Ban Island in the northwest, Miners Point in the west, Spruce Cape in the east, and Tolstoi Point in the northeast are used by Ouzinkie residents. Within this area, local residents harvest resources, in the coastal areas and waters of Tonki Bay, Marmot Strait, Izhut Bay, Marmot Bay, Kizhuyak Bay, Kupreanof Strait, Viekoda Bay, Uganik Passage, Uganik Bay, Raspberry Strait, Malina Bay, and Paramanof Bay. Coastal areas and waters, and inland portions of Spruce, Whale, Raspberry an Uganik Islands are also used. Areas close to these communities are used more intensively, particularly for harvesting salmon. Other resources harvested include salmon, crab, herring, halibut, shrimp, scallop, clam, duck, deer, rabbit, and berries.

Residents of the city of Kodiak also harvest fish and wildlife on refuge lands for subsistence purposes. Areas where Kodiak residents harvest resources for subsistence data has not been mapped by ADF&G. However, data on these areas are available in the KANA (1983) study and from ADF&G records, such as harvest tickets, permit reports, and hunter questionnaires.

Residents of the city of Kodiak most intensively use those areas reachable by road or open skiff for harvesting fish and game, including Ugak Bay, Chiniak Bay, Monashka Bay, Narrow Strait, Kupreanof Bay, and Marmot Bay. Areas further from town, including the refuge, are regularly used by hunters and fishermen on longer trips. Because of the large population of the Kodiak road-connection area, the large number of boats owned by local residents, and the high interest in fishing and hunting, almost the whole coastline of Kodiak Refuge, as well as the rest of the archipelago, receives some use from Kodiak residents:

- An estimated 8% of the households in the Kodiak road-connected area used the southeast portion of the refuge and adjacent areas in 1982-1983, with 2% of the households salmon fishing, 1% freshwater fishing, and 1% deer hunting.

- About 7% of the households in the Kodiak road-connected area used the southwest portion of the refuge and adjacent areas, with 5% salmon fishing, 1% freshwater fishing, and 3% deer hunting.

- About 12% of the households in the Kodiak road-connected area used the northwest portion of the refuge and adjacent areas, with 6% salmon fishing, 5% freshwater fishing, and 6% deer hunting.

WILDERNESS SUITABILITY

Section 1317 of ANILCA directs the Service to study all of the non-wilderness lands in the Alaska refuges and recommended areas suitable for wilderness designation. None of the lands under federal jurisdiction (1.6 million acres or 648,000 ha) within the boundary of the Kodiak Refuge was designated as wilderness by ANILCA. This section describes the process used in studying refuge lands and evaluating the wilderness qualities on those lands.

Wilderness Criteria

The Wilderness Act of 1964 defines wilderness as follows:

> A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped federal land retaining human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size at to make practicable its preservation and use in an unimpaired condition; (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

The Service used seven criteria in evaluating the wilderness qualities of the Kodiak Refuge: land ownership; natural integrity of the area; apparent naturalness; opportunities for solitude; primitive recreation opportunities; size; and the presence of special or unique features. This evaluation will determine what lands within the refuge, if any, meet the criteria necessary for designation as wilderness based solely on those seven identified criteria and without regard for possible uses on or management of these lands.

Land Ownership

Only areas where the federal government owns both surface and subsurface rights were considered for wilderness designation. Specifically, conveyed lands and lands with encumbrances in the refuge were not considered for wilderness designation; selected lands may or may not be suitable for designation depending on the final determination of the land status. About 73% of the land within the refuge boundary is administered by the federal government presently, and thus is eligible for wilderness designation; another 15% of the lands within the refuge boundary have been selected by Native corporations and may become eligible for wilderness designation. (Current land status is discussed at the beginning of this chapter.)

Natural Integrity

This criterion refers to the degree to which an area retains its primeval character and influence from an ecological perspective. Most of the fish and wildlife populations and ecological systems in the refuge have not been significantly affected by people due to the remoteness of the refuge, the ruggedness of the landscape, and the harshness of the weather--the natural integrity of the refuge has been retained.

Apparent Naturalness

Apparent naturalness refers to the degree to which a landscape appears natural to most people if it was disturbed by man's activities in the past. As noted above, the refuge generally has not been affected by man's activities. Few permanent improvements and no permanent human habitations are present.

Opportunities for Solitude

Naturalness and solitude are the distinguishing qualities of designated wilderness areas. They are the principle criteria that guide the management of wilderness. Solitude refers to the degree of isolation from the sights, sounds, and presence of others and from the developments and evidence of man. A wilderness area has to provide "outstanding" opportunities for solitude, according to the Wilderness Act. The Kodiak Refuge is remote and receives relatively few visitors. Few developments and other evidence of man (either by sight or sound) are present. Local residents harvest natural resources in coastal areas of the refuge. Visitors use refuge resources for consumptive and nonconsumptive purposes, but they generally do not stay long. Thus, these lands provide outstanding opportunities for solitude.

Primitive Recreation Opportunities

To be a primitive recreation experience, visitors should perceive a vastness of scale, a feeling of being isolated from others, being part of the natural environment, a high degree of challenge or risk, and a need for outdoor skills. Primitive recreation is characterized by self reliance, meeting nature on its own terms, without comfort and convenience facilities. Few areas would rank as high as the Kodiak Refuge in terms of these qualities. The ruggedness of the terrain and the harshness of the weather force a visitor to meet nature on its own terms. Few visitors come here and none stay long.

Size of the Area

The Wilderness Act requires that a wilderness area be of sufficient size so as to make practical its preservation and use in an unimpaired condition. On Kodiak Refuge, no small blocks of isolated wilderness that could cause management problems are anticipated. The Service's wilderness proposals exclude most of the coastline and rivers with private inholdings or Native selections.

Special or Unique Features

This criterion refers to special ecological features (e.g., threatened or endangered species, wilderness dependent species, unusual plant or animal communities), landforms that represent significant examples of geological processes (e.g., natural bridges, mass movement areas, caves, lava flows, glaciers), scenic values, and cultural features. Kodiak is one of the largest islands in North America. The diversity of resources and uses in the Kodiak Refuge, including landforms, fish and wildlife, and subsistence and recreational uses, and the rich archeological/anthropological history of the area, is unique--these features, taken together, cannot be duplicated anywhere else in Alaska.

The topography varies greatly on Kodiak Refuge, from relatively low rolling hills, broad valleys, and long, meandering streams in the southwest becoming progressively higher and much more precipitous with narrow steep walled valleys, deep, fjord-like bays, and fast flowing, relatively short streams toward the northeastern portions of the Kodiak Island unit of the refuge. The Afognak Island unit of the refuge is characterized by extremely rugged, steep terrain and a rocky, broken shoreline. This range of topography forms a unique continuum which has no parallel in the refuge system; nor, probably, in North America.

Related to the above point, Kodiak is characterized by a large range of habitats in a relatively small geographical area. These habitats range from ocean beaches and salt water estuaries through rivers (with extensive salmon runs), wet tundra, and rolling hills to extensive brushlands and alpine areas and at the highest elevations bare rock and snowfields with hanging and cirque glaciers. Furthermore, these habitats are distributed in different combinations over the entire refuge. Because nearly all animals require several habitat types to fulfill their ecological requirements, this diversity and mix of habitats in close proximity permits animals to meet all their life requirements in the smallest possible geographical area. The result is that Kodiak Refuge boasts the highest densities of brown bears, nesting bald eagles, and spawning salmon found anywhere in North America.

In wilderness, the free play of natural forces and events are necessary to perpetuate the evolving creation inherent to the area. The primary reasons that Kodiak was considered important enough to designate as a national wildlife refuge were its diversity of habitats, its densities of brown bears, and the true and unique wilderness character of the area. For this discussion, the refuge wilderness proposal has been divided into four units so that the special features of these areas can be more specifically described.

Wilderness Review Units

To analyze the wilderness suitability of Kodiak Refuge, the refuge was divided into four geographically distinct wilderness review units: the Ayakulik/Uyak, Zachar/Uganik, Spiridon Peninsula/Uganik Island, and Red Peaks/Ban Island units.

Ayakulik/Uyak Unit

This unit is renowned for its aggregation of species occurring in densities that are not found elsewhere. The Ayakulik/Red River is the largest watershed on Kodiak Island and is one of the two most productive salmon streams on Kodiak. This unit also contains the headwaters of the refuge's other large system - the Karluk River. ADF&G estimates that the Ayakulik and Karluk systems together produce 25 to 40 percent of the entire Kodiak Island pink salmon escapements in even years. Very large runs of sockeye and coho also use these systems annually. The Dog Salmon River/Frazer Lake drainage is another very important salmon system in this unit. Several small but very important anadromous fish streams are distributed throughout the unit. In close proximity to these productive streams are extensive brushlands containing several species of berries. At higher elevations are subalpine

High densities of bald eagles are found in the Ayakulik/Uyak wilderness unit.

habitats that provide extensive key brown bear denning habitat. As a result, this unit contains some of the best brown bear habitat on earth. The area is a key feeding habitat in summer and fall for hundreds of bald eagles and contains key eagle nesting habitat. The Ayakulik/Uyak Unit includes several other special features:

- The Kodiak Island Refugium (discussed elsewhere in this plan) is contained in this unit. The refugium possesses unique geologic and floral characteristics not found elsewhere on Kodiak.
- The unit contains the most productive waterfowl nesting habitat on the Kodiak Archipelago.
- The area's streams provide spawning area to literally millions of salmon each year, contributing brood stocks that support a multi-million dollar commercial fishery.
- The Ayakulik/Red River is one of only two rivers on Kodiak which sustains major runs of chinook salmon and steelhead trout; the river supports one of the biggest sockeye salmon runs on Kodiak.
- Human use of the entire area is principally restricted to short term recreational visits by sport hunters, fishermen, and photographers.
- Four refuge recreational cabins provide rustic shelter in popular recreational areas in the unit. The presence of these small rustic structures does not detract from the wilderness qualities of the area. ADF&G maintains a step pass fishway at Frazer Falls and a temporary incubation facility on the Upper Thumb River as part of their fisheries development program.

Zachar/Uganik Unit

Deep, fjord-like bays indent the shoreline of this area and relatively short, swift streams flow through steep walled valleys. The unit contains much of the most rugged and scenic mountainous terrain on Kodiak Island. Several small cirque and hanging glaciers are found at the highest elevations of this unit - the only glaciers on the Kodiak Archipelago.

Numerous streams provide extensive spawning areas for large runs of pink and coho salmon. The Uganik systems also provides spawning area for a minor sockeye run. The Uganik alpine area is used extensively by over 100 brown bears for summer feeding and is also key winter denning area. Research in the early 1970's showed that the bears feeding in this high alpine area feed almost exclusively on one species of sedge (Carex machrocheata). Females with young constitute a high percentage of the animals. This summer alpine feeding behavior is known to occur in only a few other areas, most notably in the Soviet Union, the Brooks Range of northern Alaska, and certain areas of southeastern Alaska. Densities of bears in these other areas are much lower than the Uganik alpine area.

Although a relatively large number of visitors, in relation to the rest of the refuge, use this area for recreational purposes, their visits are generally quite short - rarely more than ten days.

One public use recreational cabin at Uganik Lake is the only structure in this unit, and it does not detract from the wilderness quality of the area.

The high wildlife values, the spectacular scenery and the potential for high quality wilderness recreation all contribute to the extremely high wilderness values of the unit.

Spiridon Peninsula/Uganik Island Unit

This unit shares many of the wilderness qualities with the previously described areas. It is contiguous with the Zachar/Uganik unit and is broken out as a separate unit here to accommodate all alternatives in this plan.[a]

The Spiridon Peninsula and Uganik Island both extend into Shelikof Strait, which is notorious for its high winds and severe weather. Both areas have relatively open vegetation by Kodiak standards with a lower percentage of brushlands and a higher percentage of grasslands. The terrain here is similar to the terrain of the Ayakulik unit, consisting of rolling hills and less rugged mountains.

One major salmon stream (Little River) flows through the Spiridon Peninsula, providing spawning area for large runs of sockeye, pink, and coho salmon. This stream also supports populations of rainbow trout, steelhead, and Dolly Varden.

Large numbers of Sitka blacktail deer winter on the outer capes of the two areas. The major human activity in these area is deer hunting, with bear hunting a distant second. The areas lend themselves well to deer hunting because of their relatively open vegetation, less rugged terrain, and the very high densities of deer.

Because of the open nature of these areas' vegetation and more rolling terrain, any human development would be very conspicuous and would detract from the wilderness character of the areas. Two small public use recreation cabins are currently maintained in the unit. The Uganik Island cabin is well concealed in a small grove of cottonwood trees and is unobtrusive. The Little River Lake cabin blends fairly well with its environs and provides safe shelter to recreational hunters during severe fall storms.

Red Peaks/Ban Island Unit

This area was recommended by the Forest Service for inclusion in the wilderness system during the Roadless Area Review and Evaluation (RARE) II process. At that time, the unit was part of the Chugach National Forest. The Ban Island/Afognak Island unit was added to the Kodiak Refuge by ANILCA in 1980.

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[a] In Alternative B these areas would be designated for moderate management, which is inconsistent with wilderness designation.

The area is located on the northwest side of Afognak Island facing Shelikof Strait. The terrain is extremely rugged with jagged mountain peaks, pinnacles, steep talus slopes and very broken, rugged shoreline. Except for the highest elevations, the area is completely timbered with a stand of Sitka spruce. The spruce are believed to have pioneered here in the last few hundred years, making this an unique evolving forest ecosystem. The spruce forest here is also unique in that Sitka spruce normally occurs only in association with other tree species. The monotypic overstory in the Red Peaks unit would be unique in the National Wilderness System. This is the only spruce forested area on Kodiak Refuge. Foul Bay and Paramanof Bay provide critical habitat for large numbers of sea otter, and Foul Bay is thought to be an important "nursery" area for females with young. Kodiak Island's sea otter population is still recovering from near extinction during the Russian period when they were heavily hunted for their hides.

Roosevelt elk frequent this unit seasonally. This is one of the few national wildlife refuges (and the only one in Alaska) where Roosevelt elk occur.

Brown bears, bald eagles, deer, and other wildlife also use the area extensively throughout the year.

No developments currently exist on this unit. The area is thought to be economically infeasible for logging because of its rugged terrain, difficult access, and harshness of the weather. All of the remainder of Afognak Island is now privately owned and much of the island is being or could be logged in future.

VI. MANAGEMENT ALTERNATIVES

VI. THE MANAGEMENT ALTERNATIVES

This chapter consists of three parts: a description of the management categories that make up each alternative; a description of the management directions common to all of the alternatives; and a description of the alternatives themselves. In addition, this chapter identifies the Service's responsibilities for Native conveyed lands, and identifies areas that would be suitable to recommend for wilderness designation under each of the management alternatives. All of these sections form the core of the draft Kodiak Refuge Comprehensive Conservation Plan/EIS.

MANAGEMENT CATEGORIES

According to ANILCA the comprehensive plan for Kodiak Refuge must: (1) designate areas within the refuge according to their respective resources and values, (2) specify management programs to conserve fish and wildlife resources in each area, and (3) specify uses within each area that may be compatible with refuge purposes. Comprehensive planning must also comply with the National Environmental Policy Act (NEPA), which requires that reasonable alternatives be considered.

To develop management alternatives that meet the requirements of ANILCA three management categories were identified for Kodiak Refuge. Each management category provides overall direction for managing a given area in light of its resources and existing and potential uses. Table 14 shows what management activities, public uses and economic uses would be permitted (i.e., compatible) in each management category, as required under Section 304(g)(3)(A)(iii); Table 15 describes in more detail what activities would be permitted on the refuge and under what conditions. All references to access on the refuge are subject to the provisions of Section 1110(a) of ANILCA.

The three management categories used in developing management alternatives for Kodiak Refuge are as follows:

Moderate Management (I)

Moderate management areas are intended to provide opportunities for public use and limited commercial development, while protecting fish and wildlife populations and habitats. Access by floatplanes, motorboats, jet boats, and snowmachines for recreational purposes would be permitted with reasonable regulations. Public use facilities, such as cabins and campsites, could be provided. Moderate management areas could therefore provide increased opportunities for recreational hunting, fishing, and trapping. Guiding and outfitting services and related temporary support facilities would be permitted; the facilities would have to be dismantled after the season of use but could be stored on-site. The number of guides and outfitters, as well as the location of temporary support facilities, may be regulated by provisions of management plans or special use permits. Existing valid onshore commercial fishing and guiding support facilities on the refuge would continue to be permitted, and additional temporary facilities may be permitted; new permanent facilities, however, would not be permitted. Replacement of existing permanent commercial support facilities with new structures of a size

Table 14. Summary of permitted activities and uses on Kodiak Refuge.

LAND MANAGEMENT CATEGORY MANAGEMENT ACTIVITIES	I MODERATE MANAGEMENT	II MINIMAL MANAGEMENT	III SPECIAL RIVER MANAGEMENT
TERRESTRIAL RESOURCE MANAGEMENT ACTIVITIES			
• Research and management studies	●	●	●
• Ecological monitoring	●	●	●
• Wildlife inventories	●	●	●
• Marking and banding	●	●	●
• Wildlife habitat manipulation	◓	◓	◓
• Native Wildlife Species Introduction	◓	◓	◓
• Wildlife stocking	◓	◓	◓
• Predator control	◓	◓	◓
• Pest control	◓	◓	◓
• Disease prevention and control	◓	◓	◓
• Fire suppression	◓	◓	◓
AQUATIC RESOURCE MANAGEMENT ACTIVITIES			
• Fishery management studies	●	●	●
• Fishery research special studies	●	●	●
• Ecological monitoring	●	●	●
• Permanent fish passes	◓	◓	◓
• Temporary fish passes	◓	◓	◓

● Activity or use is permitted

◓ Activity or use may be permitted based on a site-specific evaluation; a compatibility determination must be made for this activity or use

○ Activity or use is not permitted

Table 14. Summary of permitted activities and uses on Kodiak Refuge (continued).

LAND MANAGEMENT CATEGORY MANAGEMENT ACTIVITIES	I MODERATE MANAGEMENT	II MINIMAL MANAGEMENT	III SPECIAL RIVER MANAGEMENT
AQUATIC RESOURCE MANAGEMENT ACTIVITIES			
· Permanent fish wiers	●	◒	◒
· Temporary fish wiers	●	●	●
· Permanent spawning channels	◒	○	○
· Permanent fish hatcheries (rearing sites)	◒	○	○
· Temporary fish hatcheries[a]	◒	◒	◒
· Temporary fish egg taking sites	●	●	●
· Stream improvements	◒	◒	◒
· Chemical habitat modification	◒	◒	◒
· Predator/competitor control	◒	◒	◒
· Supplemental production fertilized egg plants	●	●	●
· Supplemental production eyed egg plants	●	●	●
· Supplemental production unfed fry	●	●	●
· Supplemental production fed fry (fingerlings)	●	●	●
· Supplemental production smolt release	●	●	●
· Supplemental production catchable fish release	○	○	○
· Exotic fish species introduction	○	○	○
SUBSISTENCE			
· Fishing, hunting, trapping, berry picking	●	●	●

● Activity or use is permitted

◒ Activity or use may be permitted based on a site-specific evaluation; a compatibility determination must be made for this activity or use

○ Activity or use is not permitted

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[a] The existing Thumb River egg-taking and incubation facility would continue to be permitted.

Table 14. Summary of permitted activities and uses on Kodiak Refuge (continued).

LAND MANAGEMENT CATEGORY MANAGEMENT ACTIVITIES	I MODERATE MANAGEMENT	II MINIMAL MANAGMENT	III SPECIAL RIVER MANAGMENT
PUBLIC USES			
• Hunting	●	●	●
• Sport fishing	●	●	●
• Trapping	●	●	●
• Primitive camping	●	◒	◒
• Wildlife observation	●	●	●
• Interpretation	●	●	●
PUBLIC ACCESS METHODS			
• Hiking	●	●	●
• Power boats	●	●	◒
• Float planes	●	●	◒
• Land planes	◒	◒	◒
• Helicopters	◒	◒	◒
• Snowmobiles	◒	◒	◒
• Off Road Vehicles (ORVs)	○	○	○
PUBLIC FACILITIES			
• Improved campsites	◒	○	○
• Recreational cabins (New)	◒	○	○
• Visitor contact facilities	◒	○	○
• Foot trails	◒	○	○

● Activity or use is permitted

◒ Activity or use may be permitted based on a site-specific evaluation; a compatibility determination must be made for this activity or use

○ Activity or use is not permitted

Table 14. Summary of permitted activities and uses on Kodiak Refuge (continued).

LAND MANAGEMENT CATEGORY MANAGEMENT ACTIVITIES	I MODERATE MANAGEMENT	II MINIMAL MANAGEMENT	III SPECIAL RIVER MANAGEMENT
ECONOMIC USES[a]			
• Geological exploration	◒	◒	◒
• Oil and gas exploration	◒	◒	◒
• Oil and gas leasing	◒	○	○
• Sand and gravel leasing	◒	○	○
• Hydroelectric power development	◒	○	○
• Transmission lines/pipelines	◒	○	○
• Guiding/outfitting	●	●	●
• Air taxis/marine transporters	●	●	●
• Commercial fishing support facilities	◒	○	○
• Seafood processing	○	○	○
• Remote navigation/communication sites	◒	◒	○

[a] Geothermal development, coal leasing, and hard rock mining are prohibited by law.

● Activity or use is permitted

◒ Activity or use may be permitted based on a site-specific evaluation; a compatibility determination must be made for this activity or use

○ Activity or use is not permitted

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories.

TERRESTRIAL RESOURCE MANAGEMENT ACTIVITIES	Moderate Management (I)	Minimal Management (II)	Special River Management (III)
Research and Management Studies Collection of data necessary for refuge management decisions or to futher science. Priority will be given to studies that contribute to the use and management of native fish and wildlife populations and their habitats. Studies may be conducted by the Service or by other researchers under Service guidance.	Will be routinely permitted provided the studies do not conflict with refuge purposes	Same as (I)	Same as (I)
Ecological Monitoring Activities or studies that examine how wildlife and their habitats are changing, due to either natural or human causes.	Will be routinely permitted provided the monitoring does not conflict with refuge purposes	Same as (I)	Same as (I)
Wildlife Inventories Using acceptable management techniques to obtain information on species distributions, harvests abundance, habitats, and population dynamics to meet refuge objectives.	Will be routinely permitted provided the inventories do not conflict with refuge purposes	Same as (I)	Same as (I)
Marking and Banding To contribute information on population trends, survival, and movements necessary for the overall management of the species. Cooperation with other scientific institutions will be stressed.	Service marking and banding will be routinely practiced. Programs initiated by other scientific institutions may be allowed, under Service guidance, if they do not conflict with Service objectives	Same as (I)	Same as (I)
Wildlife Habitat Manipulation Modification of habitats to increase target wildlife populations. Includes both enhancement and restoration activities, such as prescribed burning and mechanical manipulation.	Will occur only in cases where people have altered or degraded the natural system or unacceptable natural changes have altered the desired habitat	Same as (I) except mechanical manipulation would not be done	Same as (I)
Native Wildlife Species Introduction Any indigenous species native to North America, translocated directly or indirectly by man from outside its original range.	Permitted only if the introduction is an extension of the species' range, and it is compatible with refuge purposes	Same as (I)	Same as (I)

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories (continued).

TERRESTRIAL RESOURCE MANAGEMENT ACTIVITIES	Moderate Management (I)	Minimal Management/ Proposed Wilderness (II)	Special River Management (III)
Wildlife Stocking Used to reestablish native species within their original breeding range, to augment depleted native populations, and to maintain desired species.	Only initiated to reestablish native species within their original breeding range	Same as (I)	Same as (I)
Predator Control Relocation or removal of predators to favor other wildlife populations or to protect introduced or reintroduced species.	May be permitted where biologically justified	Same as (I)	Same as (I)
Pest Control Relocation or removal of organisms that threaten human health and property or survival of wildlife species.	Will not normally occur except to control exotic species; native species may be controlled where severe resource danger is likely or where public health or safety is jeopardized	Same as (I)	Same as (I)
Disease Prevention and Control Management practices directed at controlling pathogens that threaten wildlife, and people. Includes rabies control and parasite control.	Will not normally occur except where severe resource damage is likely or where public health or safety is jeopardized	Same as (I)	Same as (I)
Fire Suppression Actions taken to suppress wild fires, (man-caused or natural), such as building fire breaks.	Natural fires permitted to burn except where they threaten human life, property, administrative facilities, or private lands; minimum tool concept will be employed	Same as (I)	Same as (I)

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories (continued).

AQUATIC RESOURCE MANAGEMENT ACTIVITIES	Moderate Management (I)	Minimal Management (II)	Special River Management (III)
Fishery Management Studies Collection of data on fish populations or habitats necessary for management activities. Priority will be given to studies that contribute to management of native wild fish populations and habitats.	Will be routinely permitted provided the studies do not conflict with refuge purposes	Same as (I)	Same as (I)
Fishery Research Special Studies Collection of data on specific fish populations or their habitats in response to a direct management oriented request by either the Service or ADF&G. Priority will be given to those studies that contribute to the management of native wild fish populations and habitats.	Will be routinely permitted provided the studies do not conflict with refuge purposes	Same as (I)	Same as (I)
Ecological Monitoring Activities or studies that examine how fish populations and their habitats are changing due to either natural or human causes.	Will be routinely permitted provided the monitoring does not conflict with refuge purposes	Same as (I)	Same as (I)
Fish Passes The construction or installation of a fish ladder, or removal of a barrier (e.g., beaver dams), to enable fish to get past a natural or man-made barrier and reach spawning grounds; the fish pass may be either temporary or permanent.	Existing passes will be allowed to continue current operations; new temporary or permanent facilities may be permitted provided the facility does not conflict with refuge purposes and it can be demonstrated to be the minimum tool necessary to meet management objectives	Same as (I)	Same as (I)
Fish Weirs The construction and installation of an in-stream fish counting facility. Weirs may be either permanent or temporary, the difference being that a permanent weir has a permanent in-stream anchoring device, while a temporary weir does not. The above-water structure for both types of weirs would be removed after the season of use.	Permanent and temporary weirs permitted as long as the facility does not conflict with refuge purposes; permanent in-stream anchoring devices would be permitted	Temporary weirs permitted as long as the facility does not conflict with refuge purposes; permanent weirs may be permitted	Same as (II)
Permanent Spawning Channels The construction and maintenance of an artificial gravel laden channel where water quantity could be controlled to facilitate spawning by fish.	May be permitted if the facility does not conflict with refuge purposes	Not permitted	Not permitted

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories (continued).

AQUATIC RESOURCE MANAGEMENT ACTIVITIES	Moderate Management (I)	Minimal Management (II)	Special River Management (III)
Hatchery (Fish Rearing Site) The construction and operation of a permanent production hatchery, operated either seasonally or year-round, or a temporary hatchery to incubate fish eggs or rear fry and fingerlings or smolt for release into an aquatic environment.	Temporary hatcheries may be permitted provided the facility does not conflict with refuge purposes;a new permanent hatchery may be permitted if compatible with refuge purposes and it can be demonstrated to be the minimum tool	The existing Thumb River egg-take and incubation facility would continue to be permitted; a new temporary facility may be permitted if compatible with refuge purposes and it can be demonstrated to be the minimum tool; permanent hatcheries not permitted	A temporary hatchery may be permitted if compatible with refuge purposes and it can be demonstrated to be the minimum tool; permanent hatcheries not permitted
Temporary Fish Egg Taking Site The installation and operation of a temporary facility that uses adult spawning fish to take eggs for the establishment of a brood stock or for use in supplemental production; both the facilities and activity would be on an as needed basis.	Permitted provided the facility does not conflict with refuge purposes	Same as (I)	Same as (I)
Stream Improvements Activities designed to physically modify aquatic habitats for the purpose of affecting production of a target fish species, such as bank stabilization or installation of instream structures to increase pool/riffle rations, reduce bed load movement or alter stream velocities; the change may be either permanent or temporary	May be permitted provided the activity or environmental modification does not conflict with refuge purposes	Same as (I)	Same as (I)
Chemical Habitat Modifications (lake fertilization) Introducing either organic or inorganic chemicals on an annual on temporary basis to an aquatic environment to control production of a target fish species.	May be permitted on a case by case basis	May be permitted on a case by case basis	May be permitted on a case by case basis
Predator/Competitor Control Removing or reducing predators or competitor fish species for the purpose of increasing the production of a desirable target fish species.	May be permitted provided the activity does not conflict with refuge purposes	May be permitted on a short-term basis as long as the activity does not conflict with refuge purposes	Same as (II)
Supplemental Production Fertilized Egg Plants Planting fertilized eggs taken from a natural occurring fish stock and introducing the eggs into an in-stream environment with no artificial incubation occurring prior to planting.	Permitted provided the activity does not conflict with refuge purposes	Same as (I)	Same as (I)

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories (continued).

AQUATIC RESOURCE MANAGEMENT ACTIVITIES	Moderate Management (I)	Minimal Management (II)	Special River Management (III)
Supplemental Production Eyed Egg Plants Planting fish eggs which have been incubated artificially at a hatchery or temporary rearing facility to the eyed stage and are subsequently introduced into an aquatic environment for further natural development and hatching.	Permitted provided the activity does not conflict with refuge purposes	Same as (I)	Same as (I)
Supplemental Production Unfed Fry Planting unfed fry that have been hatched artificially at a hatchery or temporary rearing facility and are then introduced into an aquatic environment	Permitted provided the activity does not conflict with refuge purposes	Same as (I)	Same as (I)
Supplemental Production Fed Fry (Fingerlings) Planting fed fry that have been hatched and fed under artificial means at a hatchery or temporary rearing facility and are then introduced into an aquatic environment.	Permitted provided the activity does not conflict with refuge purposes	Same as (I)	Same as (I)
Supplemental Production Smolt Release Planting pre-smolts or smolts that have been hatched and reared under artificial means at a hatchery or temporary rearing facility and are then introduced into an aquatic environment.	Permitted provided the activity does not conflict with refuge purposes	Same as (I)	Same as (I)
Supplemental Production Catchable Fish Release Planting catchable size fish that have been hatched and reared under artificial means at a hatchery or temporary rearing facility until they are at a size desirable to establish or supplement a sport fishery.	Not permitted	Not permitted	Not permitted
Exotic Fish Species Introduction Introduction of non-native fish species into a natural aquatic ecosystems.	Not permitted	Not permitted	Not permitted
SUBSISTENCE ACTIVITIES			
Fishing, Hunting, Trapping, Berry Picking The taking of fish and wildlife and other natural resources for personal consumption or as provided by law. Includes all means of traditional access and traditionally used camping areas.	Permitted subject to reasonable regulation	Same as (I)	Same as (I)

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories (continued).

PUBLIC USES	Moderate Management (I)	Minimal Management (II)	Special River Management (III)
Hunting A traditional, legitimate form of outdoor recreation and a recognized tool for wildlife management.	Sport hunting permitted; pertinent state and federal regulations apply	Same as (I)	Same as (I)
Sport Fishing A traditional, legitimate form of outdoor recreation.	Sport fishing permitted; pertinent state and federal regulations apply	Same as (I)	Same as (I)
Trapping Trapping of furbearers for private use or commercial sale; also used as a wildlife management tool.	Permitted subject to pertinent state and federal regulations	Same as (I)	Same as (I)
Primitive Camping Sites selected by users to pitch tents overnight. The Service does not maintain or improve these sites.	Permitted subject to time limitations	Same as (I)	May be permitted in designated areas, subject to time limits
Wildlife Observation Wildlife, wildlife habitat, and landscape features viewed and enjoyed in their natural setting. Includes photography and bird watching.	Permitted subject to temporal or spatial restrictions	Same as (I)	Same as (I)
Interpretation To broaden public awareness and appreciation of fish and wildlife resources and their habitats, cultural resources, and scientific resource management practices. To inspire visitors to want to further their own comprehension of wildlife habitat and resource issues as they relate to society's needs.	Interpretive facilities and materials may be provided, including nature trails and signs; other facilities not provided	Interpretive materials may be provided; limited to leaflets, rustic signs and other materials that relate to wildlife and management topics	Same as (II)

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories (continued).

PUBLIC ACCESS METHODS	Moderate Management (I)	Minimal Management (II)	Special River Management (III)
Hiking Access via foot trails or cross-country in the absence of a trail system.	Foot access permitted	Permitted	Permitted
Power Boats Includes in-board and out-board power boats, jet boats	All recreational power boats, except air boats, and air cushion boats permitted subject to reasonable regulations regulations	All recreational power boats, except air boats, air cushion boats and jet boats, permitted, subject to reasonable regulations	Use of boat motors may be restricted; air boats, air cushion boats and jet boats are prohibited
Float Planes Fixed-wing aircraft equipped for landing on water, including amphibious aircraft.	Permitted on all water areas	Same as (I)	May be restricted in some areas for resource protection
Land Planes Fixed-wing aircraft equipped with wheels or skis--not capable of water landings.	Permitted only on ocean beaches and on frozen water bodies	Same as (I)	Permitted only on frozen water bodies
Helicopters All rotary-wing aircraft that provide access to the refuge.	Recreational uses prohibited; other uses may be permitted subject to use stipulations	Same as (I)	Same as (I)
Snowmachines Includes all snowmachines with an overall width of less than 40 inches (100 cm).	May be permitted during periods of adequate snow cover, subject to reasonable regulations	Same as (I)	Same as (I)
Off Road Vehicles (ORVs) Includes air boats, air-cushion boats, 4x4s, tracked vehicles, and hovercraft; snowmobiles are not included as ORVs.	Not permitted	Not permitted	Not permitted

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories (continued).

	Moderate Management (I)	Minimal Management (II)	Special River Management (III)
PUBLIC FACILITIES			
Improved Campsites Permanent site clearings that may include leveled areas for tents, tent platforms, picnic tables, shelters, fire rings, and sanitary facilities.	May be provided	Not provided	Not provided
Recreational Cabins Small, permanent structures available for overnight use by the general public.	Existing cabins will be maintained; new cabins may be built in high use areas if they do not conflict with refuge purposes	Existing cabins may be maintained; no new cabins will be built	Same as (II)
Visitor Contact Facilities A variety of staffed and unstaffed structures where the public can learn about and obtain information on the refuge and its resources.	May be provided if compatible with wildlife resources	No facilities provided	No facilities provided
Foot Trails Designated, maintained routes that are restricted to walking. Includes interpretive trails, long-distance trails, and campsite trails. May include signs, bridges, wayside facilities, and sanitary facilities.	Trails may be built	No trails provided	No trails provided
ECONOMIC USES*			
Geological Exploration Includes surface rock collecting, gravimetric surveying, and geological mapping activities.	May be permitted on a site-specific basis, subject to reasonable regulations	Same as (I)	Same as (I)
Oil and Gas Exploration Seismic surveying techniques used to identify commercial deposits of oil and gas.	Seismic surveying may be permitted on a site-specific basis, subject to reasonable regulations	Same as (I)	Same as (I)

*Geothermal development, coal leasing and hardrock mining are prohibited by law.

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories (continued).

ECONOMIC USES	Moderate Management (I)	Minimal Management (II)	Special River Management (III)
Oil and Gas Leasing Drilling and extraction of oil and gas for commercial	May be permitted if determined to be in the national interest	Not permitted	Not permitted
Sand and Gravel Leasing Extraction of sand and gravel for commercial purposes. Restricted to small-scale, single-unit operations.	May be permitted on a site-specific basis, subject to reasonable regulations	Not permitted	Not permitted
Hydroelectric Power Development This activity includes both low-head hydroelectric and major hydroelectric developments, and associated facilities (e.g., penstocks, powerhouse, tailrace).	Low-head hydroelectric developments may be permitted on a site-specific basis; major developments not permitted	Not permitted	Not permitted
Transmission Lines/Pipelines Includes telephone and electrical power lines, oil and gas pipelines, and other necessary related facilities.	May be permitted on a site-specific basis subject to restrictions on methods of transmission/pipeline placement	Not permitted	Not permitted
Guiding and Outfitting Licensed big game guides, outfitters, sport fishing guides, photographic guides, and all other commercial operators that provide services to recreationists on the refuge. Includes all activities of the operator, temporary structures (e.g., tent frames, platforms) and permanent structures (e.g., cabins, gear sheds, smokehouses).	The activity is permitted subject to reasonable regulations (e.g., duration and timing of trips, group size, location of facilities); new temporary facilities may be permitted but must be dismantled after the season of use (the facilities may be stored on-site); new permanent facilities not permitted	The activity is permitted subject to reasonable regulations; use of tents is permitted; new permanent or temporary support facilities are not permitted	Same as (II)

Table 15. Management activities, public uses, and economic uses permitted in the Kodiak Refuge management categories (continued).

ECONOMIC USES	Moderate Management (I)	Minimal Management (II)	Special River Management (III)
Air Taxis/Transporters Licensed air taxi, charter boat operators, and transporters providing transportation services for the public to refuge lands or waters.	Permitted subject to reasonable regulations.	Permitted subject to reasonable regulations	Permitted subject to reasonable regulations; use levels may be limited in specific areas to protect resource values
Commercial Fishing Includes the activity of harvesting fish for commercial purposes and all land-based support sites, activities, temporary facilities (tent frames/platforms) and permanent facilities (cabins, gear sheds, smokehouses).	Commercial fishing not permitted within the refuge; existing valid permanent support facilities permitted; no new permanent facilities permitted; new temporary facilities may be permitted with use stipulations	Commercial fishing not permitted within the refuge; existing valid temporary and permanent onshore support facilities permitted; no new temporary or permanent support facilities permitted	Same as (II)
Seafood Processing Land based processors that prepare fin fish and shell fish for market.	No new land-based processors permitted	Not permitted	Not permitted
Remote Navigation/Communication Sites Remote, unattended facilities to provide navigation or communication capabilities.	May be permitted subject to reasonable regulations	Same as (I)	Not permitted

specified in the special use permit and used for the same purpose may be allowed. Other commercial activities that could be permitted, with stipulations to protect fish and wildlife populations and habitats, include sand and gravel leasing, oil and gas exploration and leasing, low-head hydroelectric development, and transmission lines/pipelines. The Service would focus its efforts on monitoring uses and developments to minimize impacts on the area's resource values.

Minimal Management (II)

Management under this category is directed at maintaining existing fish and wildlife populations and habitats, and other resource values, in their present state. These lands generally would not be subjected to habitat alterations. Thus, minimal management areas are suitable for wilderness designation, although the Service's wilderness proposals do not necessarily include all lands in the minimal management category. Opportunities for public use and access would be available for subsistence purposes and for traditional recreational activities such as hunting, fishing, and trapping. Traditional motorized access via floatplanes and motorboats would be permitted. Valid onshore commercial fishing support facilities would continue to be permitted and additional temporary facilities may be permitted. Guiding and outfitting would be permitted in the areas. No new permanent support facilities would be permitted for either commercial fishing or guiding/outfitting operations. Oil and gas exploration would be permitted where compatible with refuge purposes. Fisheries management facilities may be built in these areas if they are compatible with the purposes of the refuge and it can be demonstrated that they are the minimum tool necessary to achieve management objectives. New management facilities would be built by the Service only as needed to properly administer the refuge. The Service would focus its efforts primarily on management studies and survey/inventory programs to increase the refuge's resource data base, and examine refuge management techniques.

Special River Management (III)

The Sturgeon, Ayakulik/Red, Karluk, and Dog Salmon drainages were identified in Chapter II as special features of Kodiak Refuge. These drainages support a natural diversity of fish and wildlife populations and high concentrations of fish and wildlife that are unique compared to the rest of the refuge. A special river management category was established in recognition of the important resource values of the four drainages and adjacent lands, their interest to the public, and the special management concerns they pose to the Service. The management category extends from the headwaters of each drainage to their mouths, and encompasses the adjacent riparian lands. The Service would protect and maintain the physical and biological qualities of the drainages and adjacent refuge lands, including water quality and quantity. Recreational use would be managed to maintain the drainages' resource values and recreational values for the visiting public. Outside of the refuge and on inholdings within the refuge the Service would seek cooperative agreements and work with village corporations and private landowners to ensure management continuity. The Service would also work with the state to ensure that water quality and fish and wildlife habitats and populations are maintained. River management plans would be completed for all of the drainages in this category. The management plans would describe what specific actions would be taken to manage both the rivers' resources and users. These management plans would form the foundation for future regulations that may be required, such as use and access regulations.

MANAGEMENT OF NATIVE CONVEYED (22g)) LANDS

When Congress enacted the Alaska Native Claims Settlement Act (ANCSA) in 1971, it permitted village corporations to select and obtain title to the surface estate of lands within established national wildlife refuges, such as Kodiak Refuge, to satisfy their entitlements under the Act. These private lands have a unique status under federal law. Congress attempted to balance "the real economic and social needs" of Alaska Natives for acquiring refuge lands against those of the nation in preserving the natural resources values of the National Wildlife Refuge System. Under Section 22(g) of ANCSA, requirements were enacted to ensure that the Native corporations' use and enjoyment of their lands would not defeat the purposes for which the wildlife refuges in Alaska had been established. One of the requirements of Section 22(g) is that refuge lands conveyed to the village corporations remain subject to the laws and regulations governing use and development of the refuge. Thus, although the Native village corporation lands are privately owned and no longer part of the refuge, the Service retains residual controls on the use and development of the lands conveyed to village corporations under ANCSA.

To determine what uses and activities would be appropriate on these private lands, the Service first classified or stratified all Native lands within the refuge boundary according to their resource values for: bald eagles, brown bear, tundra swans and salmon. While Kodiak Refuge supports a wide variety (diversity) of fish and wildlife resources, these species were selected because: (1) they were key species recognized as unique components of the refuge's ecosystem(s), and (2) habitats occupied by these species were representative of the broad spectrum of habitats used by most of the refuge's fish and wildlife resources. Native lands were classified based on the degree to which the tract supported critical life requirements for each of the species.

Next, the Service evaluated all the lands and assigned a "protection level" value, which represents a relative ranking of habitat importance to each of the species' life requirements. Those tracts considered most critical from a population survival standpoint were assigned a Protection Level I, while those least critical were assigned a Protection Level III. Protection Level II was an intermediate category---important but not considered critical from a species survival standpoint. This evaluation was based on the refuge planning team's knowledge of: (1) species requirements; (2) past and present use of selected habitats; (3) data from wildlife field inventories and surveys; (4) a literature search regarding relative sensitivities of each of the species to disturbance from human induced activities; and (5) information from past and ongoing research projects.

Following the stratification of habitats relative to their importance in sustaining life requisites, a list of "allowable uses" or performance standards was developed for each species. The standards were developed based on the expected increases in public use levels on Kodiak Refuge over the next 10 to 20 years, and the resilience of the species to human disturbance. These standards are thought to be consistent with the intent of Department of Interior regulations (43 C.F.R. 2650.4-6(b)), which state that refuge regulations "shall permit such uses that will not materially impair the values for which the refuge was established" (emphasis added). The list of "allowable uses" is not intended to be all inclusive, but rather provides a guide for how the Service will evaluate proposed uses of Native lands.

Resource Protection Levels and Standards

Bald Eagle

To date, the productivity of bald eagles on Kodiak Refuge has not appeared to be significantly influenced by human activities (Zwiefelhofer, person. comm.). However, studies and observations conducted in other parts of the United States suggest that declines in bald eagle populations have been attributed, in part, to direct human disturbance (Sprunt, 1969). Urban sprawl, recreational developments and increasing outdoor activity in prime eagle habitat have directly and adversely affected the bald eagle (Sprunt and Ligas, 1966). ADF&G (1985) listed six possible impacts to eagles from human-related activities:

- pollution of water or food
- reduction of food supply
- disturbance during nesting
- destruction of nesting habitat
- electrocution on transmission wires; and
- illegal shooting

Hensel and Troyer (1964) reported that nest abandonment was a major factor influencing nesting success on Kodiak Refuge. This is probably due to human disturbance. In southeast Alaska, Robards and King (1966) suggest that human harassment is a factor influencing nest location. Corr (1978) also noted that disturbance during egg laying and incubation may have been an important reason for nest abandonment in southeast Alaska. Studies conducted on the Kenai National Wildlife Refuge (Bangs, Bailey and Berns, 1981) indicated that human disturbance adversely affected the nesting use and reproduction success of eagles. Like the Kodiak Refuge, disturbance was related to recreational activities such as boating, canoeing and camping rather than from industry or other development. Also similar to Kodiak, most of the human activity on the refuge occurred from the end of May to late September, coinciding with bald eagle incubation and rearing.

Although individual nest productivity was not affected, changes in nesting behavior was observed as a result of activities associated with the Terror Lake hydroelectric project in Kizhuyak Bay. A nest used prior to 1979 was abandoned and a new nest constructed approximately one-half mile (0.8 km) from the Kizhuyak Bay jetty. The move was assumed to be due to the activity in the jetty area during the courtship and early nesting period. Observations on Kodiak and elsewhere underscore the fact that nesting bald eagles are sensitive to disturbance throughout the breeding season, but are particularly sensitive in the early stages of courtship, nest selection and egg laying (USDI-FWS, 1983).

Perhaps less understood, but equally important, are the key feeding areas used by eagles during the post nesting period and extending through the winter months.

Concern over the sensitivity of wintering populations to human interferences has also been expressed (Shea 1973; Servheen, 1975; Steenhoff, 1976; Spencer, 1976; Stalmaster, 1976). Studies conducted along the Nooksack River in northwestern Washington indicated that human activity was found to adversely affect eagle distribution and behavior (Stalmaster and Newman, 1978).

Critical Life Requisites -

- o Observations on Kodiak, and elsewhere, indicate that bald eagles are most sensitive to disturbance during the early stages of the nesting period--courtship, nest selection, egg laying, and incubation. The greatest potential for nest abandonment on Kodiak Refuge is considered to be between early March to mid-May.
- o While eagles exhibit a higher tolerance to disturbance during the non-breeding season, secure feeding areas along anadromous streams are a critical component in maintaining existing productivity levels.

Protection Levels/Performance Standards - In recognition of the sensitivity of bald eagles to human disturbance, the Service would apply the following standards to the Native conveyed lands within the refuge boundary (see Figure 5 for the location of these lands).

Protection Level I - This level includes all known nesting sites and identified areas historically used as key feeding sites. These areas represent most of the riparian habitats, lakes and coastline identified in Figure 23.

Performance Standards

- o Surface disturbance resulting from construction of cabins, lodges, tent frames, roads, etc., will not be permitted within one-half mile (0.8 km) of identified nest sites.
- o Recreational activities (e.g., hunting, fishing, boating, photography, and related activities, including access) will be regulated through time and space zoning to minimize disturbance in the vicinity of nest sites--primarily from March through May.

Protection Level II - This level includes other areas commonly used by eagles for feeding or roosting. While these areas are extremely important in maintaining overall productivity levels, they are somewhat less defined on a geographical basis, encompassing broad ranges of riparian habitats.

Performance Standards

- o Surface disturbance may be permitted, but activities will be seasonally regulated to minimize disturbance.
- o Recreational activities will be permitted, but seasonal restrictions concerning use levels and location may be applied.

Protection Level III - This level includes all other habitats on Native lands that receive intermittent or occasional use. For the most part, they are habitats that presently are, and historically have been, subjected to more intensive levels of development and human disturbance.

Performance Standards

- o All construction, operation, and maintenance of facilities, and all other activities will be conducted so as to (1) avoid or minimize environmental changes (conforming to existing borough, state and federal environmental protection regulations), and (2) provide protection to bald eagle populations, and their habitats (conforming to existing general state and federal regulations, such as the natural resource regulations of ADF&G, the Bald Eagle Act, the Migratory Bird Treaty Act, and ANILCA).

Brown Bear

Documentation of past and current distribution of brown/grizzly bear (Ursus arctos) populations throughout the world has clearly demonstrated that the species is adversely affected by increasing levels of human development and activity (Cowan, 1972; Stebler, 1972). Populations are reduced indirectly through habitat destruction and directly by increased mortality caused by improved access for sport hunters and bear/man conflicts (Jonkel, 1978).

ADF&G (1985) listed four possible impacts to brown bears from human-related activities:

- o pollution of water or food supply
- o reduction in food supply
- o disturbance during denning/abandonment of young; and
- o illegal hunting/kills in defense of life and property

Viable populations of brown/grizzly bears continue to exist in Alaska primarily because they occupy areas of rugged physiography or inaccessible habitat (Craighead and Mitchell, 1982). However, Reynolds (1980) pointed out that "... these obstacles to resource development and access no longer impede expansion of human activities." Erickson (1965) noted that a reduction of brown/grizzly numbers was inevitable in certain areas of Alaska, but expressed the opinion that other areas should be managed as bear habitat. He identified Kodiak National Wildlife Refuge as one such area with that priority.

Kodiak Refuge encompasses roughly two-thirds of Kodiak Island and supports the highest known density of brown bear in the world (Troyer and Hensel, 1964; Cowan, 1972; ADF&G, 1985). However, the fact that Kodiak Refuge provides exceptionally prime brown bear habitat does not imply that its bear population is immune from the adverse impacts of human activity. As a case in point, brown bear numbers in parts of northeastern Kodiak Island have been markedly reduced by chronic conflicts with human activity (ADF&G, 1976). Even the more remote southwestern portion of Kodiak Island, most of which lies within Kodiak Refuge, is susceptible to sustained and detrimental encroachment by man (ADF&G, 1976).

Human activity is increasing in Kodiak Refuge, and undoubtedly will continue to increase in the future. Public use of recreational cabins is high, while commercial sport fish guiding in the refuge has dramatically accelerated in the past two years. Probably the best documentation of an increasing use and associated impacts is for sport hunting of blacktail deer (Odocoileus hemionus). Smith (1979) estimated that 957 hunters harvested about 2,500 deer in 1977 on the Kodiak Island Archipelago. In 1984 about 2,500 to 3,000 hunters took an estimated 6,225 deer (Smith 1984). An apparent detrimental impact of increased deer hunting effort is kills of bear in defense of life and property (DLP) (Bridgman, 1984). In 1984, 8 of 10 DLPs recorded for all of the Kodiak Island Archipelago, and 3 of 4 DLPs on Kodiak Refuge were associated with deer hunting activity (unpubl. data, Kodiak Refuge files). These DLPs, although small in number compared to the sport harvest of bear, are nevertheless a concern because they frequently involve females with young (unlike sport hunting) and an increasing trend could indicate an even greater level of unreported wounding or killing of bears. Habituation of brown bears to areas of high or consistent human use (e.g. sport fish and deer hunting camps, village garbage dumps, favored photography areas) creates the potential for chronic DLP problems and possible long-term effects on bear populations (McCullough, 1982; Jope, 1985).

Areas that appear to be particularly important for denning have been identified in the Terror, Uganik, Sturgeon, and Ayakulik river drainages, in the Karluk Lake area, and at the headwaters of Dog Salmon Creek, Deadman Bay and Uyak Bay (Troyer and Hensel, 1969; Lentler et. al., 1972; Berns et. al., 1980; Smith and Van Daele, 1984; and Barnes, 1984).

The impacts of human development and activity on brown bears is difficult to assess because bear population trends are especially difficult to monitor (Harris, 1984). Current knowledge, however, provides conclusive evidence that increased levels of human activity is not compatible with the activity of the brown/grizzly bear. Thus, management designed to maintain a viable brown bear population should emphasize high levels of protection until sound biological data indicates more liberal policies would not adversely affect bears. Primary objectives should be to minimize permanent and long term temporary human developments and provide a framework for imposing limitations on access (including methods of transport), and levels and distribution of human use.

Critical Life Requisites -

- o Early spring habitat: Those areas used for foraging following emergence from dens are considered critical for maintaining the bear population. The habitats are critical both for replenishment of body reserves and for survival of new-born cubs. Animals emerging from dens are nutritionally deficient; early spring habitats provide an important food source prior to the salmon runs.
- o Salmon feeding areas: The protection of key salmon feeding areas is considered critical in maintaining a positive energy flow, which in turn results in the Kodiak brown bears' larger body size, high reproductive rates, and high population densities.
- o Denning sites: Secure and undisturbed denning sites are considered critical in maintaining overall productivity levels. Bears disturbed or displaced from dens (especially sows with cubs) experience increased mortality rates, due to starvation, or lower productivity, due to expenditure of energy reserves in seeking new den sites.

Protection Levels/Performance Standards - In view of the fact that brown bear can, and have been, adversely affected over their entire range by increased levels of human development and intrusion, the Service would apply the following standards to the Native conveyed lands within the refuge boundary (see Figure 5 for the location of these lands).

Protection Level I - This level includes those areas identified as key habitat in Figure 25 (spring/summer habitat distributions) and Figure 26 (winter/early spring habitat distributions). Because these areas are considered critical in maintaining the overall brown bear population on Kodiak Refuge, the development and use of Native lands within the refuge boundary with key habitats will be subject to the following conditions:

Performance Standards

- o Construction that results in surface disturbance (e.g., cabins, lodges, tent frames, roads) will not be permitted.
  Specifically, these areas have been identified (based on critical life requisites) as the Karluk, Sturgeon, Dog Salmon and Ayakulik/Red drainage systems. These key habitat areas include lowland habitats, early spring habitats, and salmon feeding areas, as identified in Figures 25 and 26.
- o Recreational activities that result in intensified levels of human intrusion may be seasonally regulated--primarily from June through August, during the critical salmon feeding season.
- o Activities will not be permitted that are determined to interfere with denning from October to March.
- o Grazing of domestic livestock on Native lands will not be permitted.

Protection Level II - This level includes all other habitats intermittently used by bears throughout the year. Although considered important for maintenance of the population(s), they are not identified as key habitat components. These areas are identified in Figures 25 and 26 as important or general distribution habitats.

Performance Standards

- Surface disturbance will be permitted on a case-by-case basis subject to seasonal restrictions to minimize adverse effects of such development.
- Recreational activities will be permitted, but time and space zoning of such activities may be instituted if it is determined the activities may result in adverse to bears using such habitats.
- Grazing of domestic livestock will not be permitted.

Protection Level III - This level includes those habitats that have already been influenced by human habitation and development. These habitats are not considered critical from a life requisite standpoint. They are primarily near existing villages.

Performance Standards

- All construction, operation and maintenance of facilities, and other activities, will be conducted so as to (1) avoid or minimize environmental changes (conforming to existing borough, state, and federal environmental protection regulations), and (2) provide protection to brown bear populations, and their habitats (conforming to existing general state and federal regulations, such as the natural resource regulations of ADF&G, and ANILCA).

Tundra Swan

Nesting surveys conducted on Kodiak Refuge since 1980 show a breeding population of about 25 pairs, with an annual production of 30 to 35 cygnets. Small numbers of tundra swans (10 to 14 birds) have been documented wintering on the refuge near Karluk Lake.

Although the refuge's population is relatively small compared to other parts of Alaska (e.g., the Yukon-Ksukokwim Delta, Seward Peninsula, Alaska Peninsula and North Slope), it is a significant indicator of the effects of increased or intensified human activity. Swan nesting areas are located in the more remote portions of the southwest part of the refuge, so nesting swans have been relatively free of disturbance. Except in isolated situations, this same disturbance-free situations exists throughout most of the tundra swan nesting areas within Alaska. Thus, little is known regarding this species resilience or adaptation to intensified levels of human activities.

ADF&G (1985) identified eight possible impacts to tundra swans from human-related activities:

- pollution of water or food
- reduction of food supply
- alteration of freshwater habitat
- alteration of nesting habitat
- dredging/filling/draining of wetlands
- disturbance of fall/spring staging areas
- oiling of feathers; and
- in-flight hazards (e.g., transmission lines, towers)

In Alaska, observations of nesting tundra swans on Izembek National Wildlife Refuge by the refuge staff indicate a heightened sensitivity of breeding pairs just prior to nest initiation and also during the brood rearing/molting period later in the summer. Additional observations during the nesting/incubation period indicate a high rate of temporary nest abandonment from human intrusion near the nest site(s).

Trumpeter swan population surveys on the more populated Kenai Peninsula suggest that historic nest sites have been abandoned in some areas of increased human activity, such as the Swan Lake Canoe System, subdivisions along the refuge boundary, and areas of intensive floatplane access (Bailey, person. comm.). Hansen et al. (1971) found that trumpeter swan cygnet mortality in areas heavily disturbed by humans during the brood season was higher in comparison to more isolated areas, and that the swans were extremely alert to any change in the landscape within their nesting territory. The same author also found tht the greatest factor leading to increased mortality was the forced and rapid movement of cygnets, induced by human intrusion, from one body of water to one which was less secure.

Even though tundra swans on Kodiak Refuge have not been intensively studied, it is reasonable to assume, based on documented studies and observations of swan behavior elsewhere, that increased human activity within the nesting/brood rearing area could have adverse effects on this rather small but geographically isolated population.

Critical Life Requisites -

- Tundra swans require a disturbance-free environment during early stages of the breeding season (territory establishment, nest building, incubation). While this period will vary annually due to climatic differences, it generally extends from late March through mid-June. Disturbance during this period could result in nest abandonment and reduction in productivity.

- Brood rearing and molting, another critical period, usually occurs during June and July. Disturbance in this period could result in increased mortality to both cygnets and adults.

Protection Levels/Performance Standards - Although the tundra swan population on Kodiak Refuge has been relatively isolated from human disturbance, anticipated changes in land ownership and use patterns could result in potentially adverse effects. To meet its responsibilities under Section 22(g) of ANCSA, the Service would apply the following standards to the Native conveyed lands within the refuge boundary (see Figure 5 for the location of these lands).

Protection Level I - This level includes those areas where pre-nesting, incubation, molting, and brood rearing occurs. During these periods tundra swans apparently are highly sensitivity to human disturbance. The habitats are considered to be critical to maintaining the tundra swan population on the refuge. The Service therefore will apply the following standards to use and development of Native lands with these habitats:

Performance Standards

- o Construction that results in surface disturbance (e.g., cabins, lodges, tent frames, roads) will not be permitted within areas designated as key habitat shown in Figure 22.
- o Recreational activities will be seasonally regulated to ensure minimal disturbance during critical periods of nest initiation, incubation, brood rearing and molting. Although time periods will vary with annual climatic conditions, May through July is considered the most critical time on Kodiak Island.

Protection Level II - This level includes all other associated wetland habitats, generally within the southwestern portion of the refuge, which are used periodically from spring through fall.

Performance Standards

- o Surface disturbance will be permitted on a case-by-case basis subject to seasonal restrictions to minimize adverse effects of such development.
- o Recreational activities will be permitted, but time and space zoning of such activities may be required if it is determined that these activities would result in adverse effects to swans using such habitats.

Protection Level III - This level includes all other habitats on Native lands within the refuge boundary that receive only intermittent or occasional use. For the most part, they are habitats that are, and have been, subjected to more intensive levels of human disturbance.

Performance Standards

- o All construction, operation and maintenance of facilities, and all other activities will be conducted so as to (1) avoid or minimize environmental changes (conforming to existing borough, state and federal environmental protection regulations), and (2) provide protection to tundra swan populations, and their habitats (conforming to existing general state and federal regulations, such as the natural resource regulations of ADF&G, the Migratory Bird Treaty Act, and ANILCA).

Salmon

The freshwater fishery habitat of Kodiak Refuge encompasses 90 drainages, over 300 streams, and 270 lakes--many of which provide important spawning or rearing habitat for eight species of native salmonids. Commercial harvesting of salmonids is the primary source of income for Kodiak residents, generating millions of dollars. Salmonids are extremely important for subsistence users, and for the the sport fishing industry. They are also a key component in the recycling and maintenance of nutrient levels throughout much of the refuge's aquatic ecosystems.

The importance of salmon to the maintenance of the bear populations on Kodiak has been well documented in such areas as the Ayakulik/Red, Sturgeon, Karluk, O'Malley, Little and Terror rivers, Dog Salmon and Humpy creeks, the tributaries and shores of Karluk, Red and Olga lakes, and streams at the heads of Uyak, Deadman and Sula bays (Troyer and Hensel, 1969; Barnes, 1984; Smith and Van Daele, 1984).

These same riparian areas, in addition to other coastal, intertidal and interior habitats, are also considered important in maintaining the refuge's bald eagle populations (USDI-FWS, 1984). Other studies indicate that protective management of overwintering bald eagles should include maintenance of food sources to reduce winter mortality of non-breeding or sub-adult components of the populations (Stalmaster and Gessaman, 1983).

While the specific life requisites for each of the eight species of salmonids found on Kodiak vary, all of the species share similar physical habitat needs such as water quality (temperature, pH, dissolved oxygen, and turbidity), water quantity (instream flow) and substrate (spawning-rearing sites) requirements. The physical and biological requirements for each of the eight species has been well documented (ADF&G, 1985). For example, studies of steelhead in the Anchor River, in southeast Alaska, indicate that spawning mortalities of 80 to 85 percent due to flooding, sedimentation, stream temperature, and scouring of stream beds by ice (Wallis and Ballard, 1981). Bell (1973) reported that salmonid eggs and alevin (fry) suffered upwards of 85% mortality due to sedimentation and reductions in oxygen below safe levels. It is also known that turbid water will absorb more solar radiation than clear water, which may indirectly raise thermal barriers to migration (Reiser and Bjornn, 1979). Straty (1981) states that deleterious changes in freshwater quality, quantity or substrate can be detrimental to salmonid populations. Investigations of the Susitna River in southcentral Alaska found changes in water quality (turbidity) to be a strong factor influencing juvenile fish distributions (ADF&G, 1983). This study also indicated that rearing coho salmon avoid turbid water.

Sedimentation is also a key factor affecting freshwater food availability. Hall and McKay (1983) found that excessive sedimentation may inhibit production of aquatic plants and invertebrate fauna.

While the above discussion is but a small representation of many studies regarding physical habitat requirements for salmonids, they underscore the extreme sensitivity of freshwater aquatic ecosystems and the deleterious effects of altering such systems. Such actions as building roads across streams and artificially stabilizing or reducing the stability of stream banks , reducing instream flows, or discharging wastes into a stream can adversely affect salmonid productivity.

Critical Life Requisites -

- o Protection of those areas used for spawning, rearing and over wintering are considered critical components in maintaining existing salmonid productivity levels. Many of these areas have been identified for the eight salmonid species in Figures 15-21.
- o Another critical component is the maintenance of free passage into each of the riverine and lacustrine systems--salmonids must be able to reach the above habitats if they are to maintain existing productivity levels.

Protection Levels/Performance Standards - In recognition of the importance of anadromous streams and lakes in maintaining the refuge's fishery resources (as well as water quality), and the sensitivity of these systems to human disturbance, the Service has classified all the Native conveyed lands within the refuge boundary containing these systems as Protection Level I. The anadromous systems, including spawning grounds, rearing and over wintering areas, are shown in Figures 15-21. (See also Figure 5 for the location of the Native conveyed lands). Due to the small map scale, not all streams are shown in these maps; however, the areas have been identified by the Service and are on file at the Kodiak Refuge headquarters.

Performance Standards

- o Surface disturbance that may affect water quality or quantity in anadromous streams and waterbodies will not be permitted.
- o Disturbance within known spawning, rearing and overwintering areas will be avoided.
- o Free passage and movement of fish will be assured in river, lake, and coastal habitats.
- o State of Alaska water quality standards (AEDC, 1979) will be maintained throughout the refuge.

Review Process for Native Conveyed Lands

As was noted earlier, the Service has developed a process for determining those uses and other activities that would be appropriate on Native lands within the refuge boundary (Section 22(g) lands), recognizing the need to balance Native and federal interests on Native lands. This process provides guidance as to what kinds of economic uses and developments will be regarded as compatible with refuge purposes.

The Service will apply Section 22(g) using a three tier process. The refuge comprehensive conservation plan sets the general basis for determining compatibility. In developing this plan the Service assessed the fish and wildlife values of the Native lands within the Kodiak Refuge boundary. Based on these values general protection levels or guidelines, as described on the preceding pages, were assigned to the Native lands. (See Figure 36 for the geographic locations of the protection levels.) The protection levels and accompanying performance standards indicate appropriate types of uses and the level of intensity that would be compatible with refuge purposes. Thus, the refuge comprehensive conservation plan identifies where the important areas are for fish and wildlife, and establishes the Service's management intent for the Native (22(g)) lands.

Once the comprehensive conservation plan is approved, the Service will promulgate specific 22(g) regulations for Kodiak Refuge that implement the performance standards. These regulations "shall permit such uses that will not materially impair the values for which the refuge was established," as required under Department of Interior regulations (43 CFR 2650.4-6(b)). The Service's permit system then will be used to both determine if a specific use or development would be in compliance with refuge rules and regulations, and identify what stipulations or mitigation measures that may be necessary to meet the performance objectives.

Management of the Native lands will be an ongoing, cooperative process, involving both the Service and the village corporations. The intent of the 22(g) review process is to protect important fish and wildlife resource values while enabling the Native landowners to derive economic benefits from their land.

MANAGEMENT DIRECTIONS COMMON TO ALL ALTERNATIVES

The National Wildlife Refuge Administration Act, ANILCA, and several other laws and implementing regulations govern administration of national wildlife refuges in Alaska. Regardless of which alternative is selected, management of Kodiak Refuge will comply with these laws and regulations. All of the alternatives also address in varying degrees the issues raised in the public meetings. Consequently, all of the alternatives share some common management directions. Sixteen major management directions, ranging from changes in land patterns to facility needs, will be undertaken under all of the alternatives.

1) Compatibility Determination Process

The Kodiak Refuge Comprehensive Conservation Plan sets broad guidelines and policies for uses compatible with refuge purposes. Service fish and wildlife management actions generally will not require a compatibility determination. The plan clearly identifies some other administrative and public uses that are permitted and some that are incompatible. For another large group of uses, however, a site-specific evaluation must be prepared before a compatibility determination can be made. In these instances the refuge staff will evaluate the proposed use and make a decision on whether or not the use is compatible.

All formal compatibility determinations will be reviewed by the regional office to ensure that the findings are consistent with the Service's policies. A record of the compatibility determinations will be kept on file and will be used as precedents for future decisions on refuge uses.

2) Management of the Mount Glottof Research Natural Area

The Mount Glottof Research Natural Area (RNA) was established in 1975 to protect a key brown bear alpine feeding area and to provide for research on the unique alpine feeding behavior. From late July until early August each year large numbers of brown bears feed almost exclusively on newly emerging shoots of Carex machrocheata (a small variety of sedge) in the high Uganik alpine area. A study was conducted in the early 1970's to examine this feeding behavior. Further studies are needed to better define the movement pattern of these alpine feeding bears during the rest of the year.

Under all of the alternatives the Mount Glottof RNA will remain in place and will be managed as a minimal management area or as a wilderness area if it is designated by Congress. The Service will manage the area to protect its natural resource and research values. The primary human activity here is, and probably will continue to be, sport hunting for brown bear, mountain goat and deer. It is highly unlikely that sport hunting would need to be restricted in the area because the brown bear alpine feeding period does not coincide with any current hunting seasons. Human developments and other activities that would significantly impair either resource values or research studies would be prohibited.

3) Land Exchanges

The Service will pursue land exchanges for the purpose of protecting fish and wildlife and their habitats. Only the minimum interest in land necessary to reach management objectives will be considered for negotiations and care will be taken to minimize the impact on all parties concerned.

The Service will pursue land exchanges with Native village corporations to reacquire Protection Level I lands due to their high resource values. Protection Level II lands may be considered for exchange on a case by case basis.

The Service will negotiate a land exchange with the Native organizations that now control public access to the Karluk River and return control of these lands to the refuge.

On private inholdings and private lands adjacent to the refuge the Service may exchange lands to protect important fish and wildlife resources.

4) Resolution of the Status of Native Allotment Applications

There are approximately 150 Native allotment applications for lands in Kodiak Refuge. Questions regarding the validity of the applications and the locations of the sites need to be answered. The Service will work with the applicants and the Bureau of Land Management to expedite the processing of valid applications and resolve remaining questions on other applications.

5) Cooperation with Owners of Refuge Inholdings and Adjacent Lands

The Service will work to foster a spirit of cooperation and good will with its neighbors and the public under all alternatives. Specifically, the Service will keep the public informed about refuge management policies and activities; consult periodically with landowners, communities, special interest groups, and other constituents who have expressed an interest in, or are affected by, refuge programs; and respond promptly to conflicts that arise over refuge programs.

As set forth in Section 304(f) of ANILCA, the Service may seek cooperative agreements with owners of lands within, adjacent to, or near the refuge if the agreements would significantly help in achieving refuge management goals. The Service may provide technical and management assistance under these agreements. In exchange for the assistance, the owner must agree to manage the land in a manner compatible with refuge purposes, to permit the Service reasonable access to refuge lands, and to provide such other public benefits as may be negotiated.

The purposes and requirements for land bank agreements are described in Section 907 of ANILCA. Briefly, land bank agreements require an owner to retain their land for ten years (which can be extended), to manage the land in a manner compatible with the management plan, and to provide the Service with reasonable access for purposes of administering the refuge or carrying out obligations under the agreement. In exchange for this agreement, the Service may provide technical and other assistance. Native corporations and other groups receiving land under ANCSA also receive immunity from taxes, court judgments, and adverse possession.

6) Cooperation and Coordination With Other Government Agencies

The Service will continue to work closely with the federal, state and local agencies whose programs affect, and are affected by, Kodiak Refuge. Whenever possible, the Service will share equipment and aircraft costs, conduct joint wildlife surveys, exchange data, co-fund research, seek cooperative agreements, and participate in other interagency activities to meet mutual management needs.

The Service and the State of Alaska will cooperatively manage the fish and wildlife resources of Kodiak Refuge. A memorandum of understanding between the Service and ADF&G defines the cooperative management roles of each agency (see Appendix F). The Department of the Interior, Fish and Wildlife Policy: State and Federal Relationships (43 CFR 24) further addresses intergovernmental cooperation in the protection, use, and management of fish and wildlife resources. The closely related responsibilities of protecting habitat and wildlife populations and providing for fish and wildlife utilization require close cooperation of ADF&G, the Service, and all resource users.

ADF&G has egg-take, incubation and egg planting sites along the upper Thumb River, a fish pass on the Frazer Falls, and four weirs on important anadromous streams in the refuge. These existing structures will continue to be permitted in all of the alternatives. The Service will work with ADF&G to carry out other legitimate management projects. Projects proposed by ADF&G will be reviewed on a case by case basis to ensure they are compatible with refuge purposes. (See Appendices K, L, and M for cooperative agreements in effect with ADF&G.)

7) Coastal Zone Consistency

Kodiak Refuge is within the state of Alaska's coastal zone. Under Section 307(c) of the Coastal Zone Management Act the activities of all federal agencies should be consistent, to the maximum extent practicable, with the approved state coastal zone management plan. A consistency determination has been prepared for the management alternatives in the Kodiak Refuge Comprehensive Conservation Plan and is included in Appendix H. All of the management alternatives are consistent with the Kodiak Island Borough Coastal Management Program. The Service will examine all relevant proposed activities and developments to ensure that they comply with the coastal management program. The Kodiak Island Borough Community Development Department will be consulted when proposed changes would significantly affect coastal resources or represent a major change in management of the refuge.

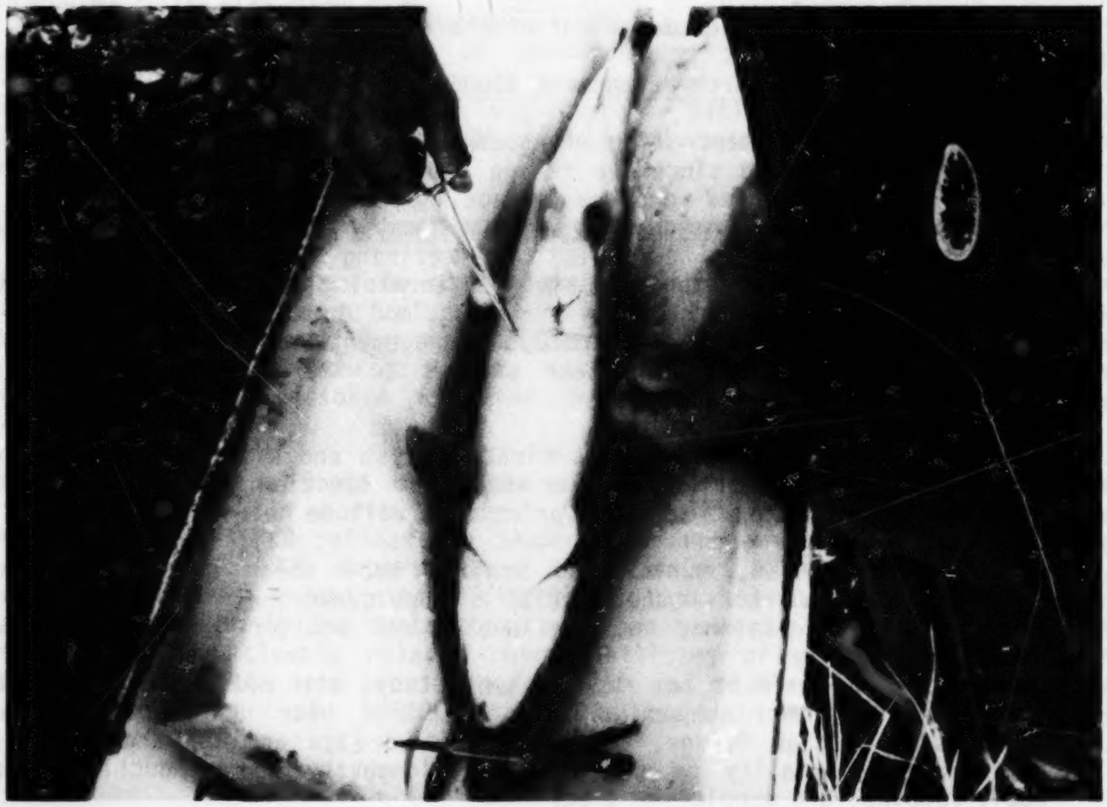
8) Data Collection and Research/Management Studies

Data collection and management oriented research has been one of the Service's priorities on Kodiak Refuge since the refuge was established. Many management studies have been conducted on the refuge, particularly on brown bear. Additional information is needed on the refuge's existing resources and users. This information is essential for refining management objectives, developing detailed management plans, determining trends, evaluating management effectiveness, identifying existing and potential problems, and generally meeting the needs of refuge management. Thus, under all alternatives the Service will undertake studies to improve the refuge data base.

Data collection and studies will focus first on fish and wildlife populations that are of high management concern or that can function as indicators of overall ecological conditions. Service priorities will be to:

- together with ADF&G, survey and monitor brown bear populations and habitats, continue to conduct aerial stream surveys for brown bear in southwest Kodiak Island, and delineate and monitor key brown bear habitats;
- develop and implement a cooperative study with ADF&G to compare attributes of two subpopulations of brown bear in northern and southwestern Kodiak Refuge; attributes include age and sex composition, differential mortality by sex and age, longevity and productivity of adult females, and population size;
- evaluate current alpine survey techniques for brown bear in the Mount Glottof RNA, analyze survey data that has been collected, and revise survey procedures based on the evaluation and analysis;

- determine seasonal habitat use of brown bears that use the Mount Glottof RNA;
- cooperate with ADF&G in monitoring and evaluating sport and non-sport mortality of brown bear;
- monitor the distribution, diversity, and abundance of migratory and nonmigratory bird species;
- determine the population sizes and delineate the habitat use of major species of waterfowl, raptors and seabirds;
- conduct investigations to upgrade sockeye production in the Karluk Lake system, and to determine the reasons for the decline of this resource;
- together with ADF&G, continue to evaluate the aquatic impacts of the Terror Lake hydroelectric facility;
- continue to support and assist, if needed, ADF&G efforts to evaluate the success of pink salmon reproduction refuge-wide;
- cooperate with ADF&G to determine the location, extent of habitat use and population characteristics of steelhead trout and chinook salmon on the Ayakulik/Red River;
- support or assist ADF&G efforts to tag sockeye salmon in bays outside of the refuge to determine their terminal destination;



Implanting a radio transmitter in a steelhead.

- determine aerial indexes of angler use on selected major river systems in the refuge.
- monitor commercial, recreational and subsistence harvests of refuge fishery resources;
- monitor, when necessary, wildlife use of refuge-based stocks to ensure adequate densities of salmon stocks for wildlife use;
- monitor sea otter populations in waters adjacent to the refuge; and
- cooperate with ADF&G in gathering population, movement, habitat use, and human impact data on resident species, including, but not limited to, deer, river otter, fox, reindeer, and mountain goat, on refuge lands and adjacent areas.

One of the four purposes for which Kodiak Refuge shall be managed, as set forth in ANILCA, is to ensure to the maximum extent practicable water quality and water quantity within the refuge. To satisfy this purpose it is first necessary to have information on the refuge's existing water quality and instream flows. Where information is lacking, the Service (working together with the U.S. Geological Survey) will gather baseline data on water quality parameters and instream flow rates for the refuge's drainages, beginning with the Ayakulik/Red, Sturgeon, Uganik, Karluk, and Dog Salmon drainages. Research also will be initiated to determine baseline water quality and quantity necessary to maintain optimum habitat conditions for both fish and wildlife populations.

The Service will closely monitor those activities that could adversely impact the refuge and its resources, such as recreational and subsistence hunting, commercial, sport and subsistence fishing, and offshore oil and gas activities. Data on public use and cultural resources will be collected and analyzed.

Section 812 of ANILCA directs the Service to undertake research on subsistence uses of the refuge. Issues raised through the state fish and game advisory system or identified by the Service will be the focus of these studies. The Service will conduct the research in cooperation with other federal agencies and ADF&G. Research results will be provided to the state and other interested parties.

The Service will encourage other researchers to study the refuge resources, if the studies meet management objectives and are compatible with refuge purposes, and will participate in cooperative studies with other state and federal organizations. Cooperative agreements with the state and with Native organizations, authorized under Section 809 of ANILCA, may be particularly useful for subsistence research and monitoring.

10) Resource Management Directions

(a) Wildlife Management

Under all alternatives the Service will protect wildlife populations and habitats in Kodiak Refuge. Under all alternatives the Service will fulfill legal requirements and treaty responsibilities relating to marine mammals, endangered species and migratory birds. The Service will also cooperate with ADF&G in managing resident wildlife, particularly brown bear, mountain goats, and blacktail deer on and near the refuge.

Habitat - All of the alternatives are based upon the principle that healthy wildlife populations in the refuge require little habitat manipulation to maintain their population levels. In the case of the refuge's game species, the Service does not foresee any need to manipulate habitats based on the availability of adequate potential habitat, cost, and the remoteness of the refuge.

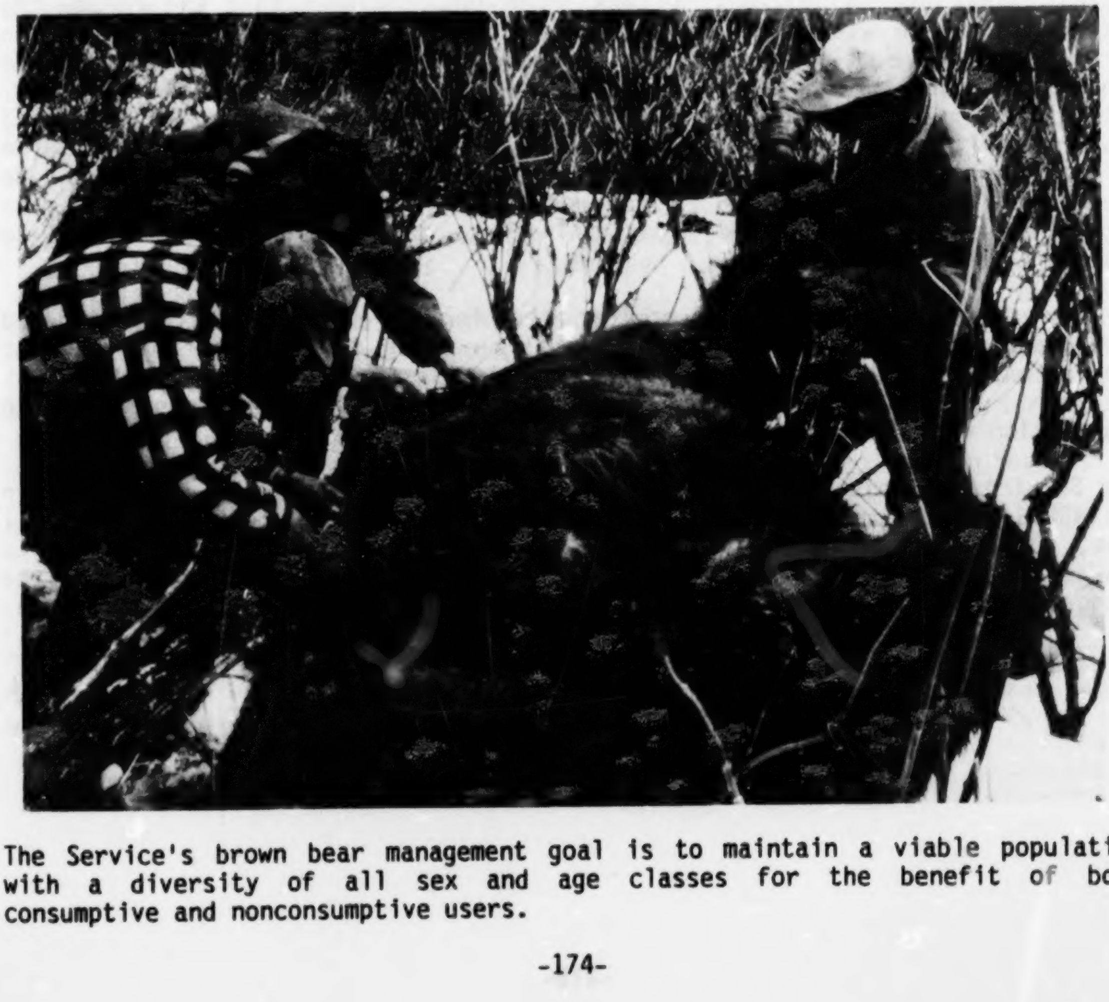
The Service will take care in all of the alternatives to minimize disturbances to those ecosystems that sustain large numbers of species. Habitats vital to individual species or sensitive to disturbance (e.g., waterfowl staging areas, bald eagle nest sites, brown bear feeding and denning areas, tundra swan nesting areas) also will be protected under all alternatives. Brown bear habitat quality will be protected through temporal and spatial regulation of human activity in key habitats, acquisition of key habitat, and public education.

National and Regional Species of Special Emphasis - As part of its regional resource planning process the Service has identified species nationally and in Alaska that are of sufficient importance or concern to merit special attention. Three national species of special emphasis (tundra swan, mallard, and bald eagle) and two regional species of special emphasis (emperor goose, Peale's peregrine falcon) use Kodiak Refuge. Another national species of special emphasis, the sea otter, occurs in waters adjacent to the refuge. (Other national species of special emphasis that have rarely been seen in the area include white-fronted goose, snow goose, and canvasback; the Aleutian Canada goose also may migrate across the refuge.) The Service has developed several general management strategies for each of these species in its Alaska Regional Resource Plan. Strategies that are relevant for refuges, such as collecting survey data, monitoring populations, and protecting habitats, are reflected in the management directions developed for the Kodiak Refuge Comprehensive Conservation Plan/EIS. Specific actions that need to be taken on the refuge to meet regional and national objectives for these species will be addressed in future management plans.

Wildlife Population Goals and Objectives - Population goals and objectives are useful guidelines for managing wildlife populations on refuges. Recognizing there may be factors affecting the refuge populations that are beyond the management purview of the Service, population goals or objectives were set for brown bear, tundra swans and bald eagle. These species have high recreation or economic values, and are important indicators of the health and stability of the refuge's ecosystems. The Service's goals and objectives all reflect the management objectives and guidelines in ADF&G's species management plans.

The Kodiak brown bear is one of the refuge's best known species, and receives national and international recognition among hunters, photographers, and scientists. The current population on the refuge is estimated at 2,000 to 2,500 animals. The Service and ADF&G's brown bear management goal is to maintain a viable brown bear population with a diversity of all sex and age classes for the benefit of both consumptive and nonconsumptive users. To achieve this, in all of the alternatives the Service will seek to protect habitat quality in the refuge, ensure that all suitable refuge habitats are occupied, and maintain subpopulation levels at or near (within the range of natural population fluctuations) present levels. Subpopulations of brown bears will be maintained at levels that provide a sustained sport harvest of bears less than the maximum sustained yield. This should assure hunters the opportunity to harvest large, old age bears and provide wildlife viewers and photographers the opportunity to observe all sex and age classes. Population levels will be monitored by analyzing sport harvest parameters (sex ratios, skull size, age distribution) and long-term aerial survey trends.

Bear/human conflicts are an important management concern in Kodiak Refuge. The Service is concerned about both protecting the refuge users' health and safety and minimizing bear kills in defense of life and property (DLP's). Human activity is anticipated to continue increasing in the refuge, increasing the potential for conflict. Sport hunting of bears probably reduces the potential for bear/human conflicts in portions of the refuge. To further prevent bear/man confrontations, the Service will educate refuge visitors on avoiding bear travel routes and seasonal concentration areas (e.g., salmon streams) and how to properly store or dispose attractants (e.g., food, garbage). Special use permittees in the refuge are required to properly dispose of garbage and minimize other attractants. The Service will also consider building meat caches by the public use cabins and at popular



The Service's brown bear management goal is to maintain a viable population with a diversity of all sex and age classes for the benefit of both consumptive and nonconsumptive users.

campsites to reduce the potential for DLPS; the need for caches at specific sites will be examined in the more detailed management plans. The Service and ADF&G recognize that transplanting nuisance bears is an impractical method of resolving bear/man conflicts because it is inefficient and costly. All Service programs and developments will be designed specifically to avoid conflicts between bears and people.

Kodiak Island's total bald eagle population is 800 to 1,200 birds, with about 200 nesting pairs occurring on the refuge annually. The Service's management objective is to maintain the present population level, as determined by long-term trends in aerial inventory data.

About 60 to 100 tundra swans use the refuge, with 20 to 30 nesting pairs. The Service's objective for tundra swan is to maintain the present population level, as determined by long-term trends in aerial inventory data.

The State of Alaska plans to introduce Vancouver Canada geese onto the refuge. Service policy permits the introduction of such species so long as it can be regarded as an extension of its range and is considered compatible with refuge purposes.

Elk may be expanding their range from Raspberry or Afognak islands to Kodiak Island. The Service believes if this expansion continues into the refuge the elk could compete with the deer population for forage and cause deterioration of watersheds due to erosion. The presence of elk also could contribute to hunter/bear conflicts because the bears would be attracted to elk carcasses, potentially resulting in an increased number of DLPs. The Service will cooperate with ADF&G to determine the desirability of establishing a program to limit expansion of elk into the Kodiak Island portion of the refuge. On the Afognak Island unit, the Service recognizes the management objectives and guidelines in the ADF&G elk management plan, and will work with ADF&G to implement these guidelines.

The Service will continue to monitor the feral reindeer herd in the Red Lake-Ayakulik River area. No action will be taken to increase this remnant population. The Service will examine the reasons for the current status of the herd (either declining or stable), and develop a management plan in cooperation with ADF&G on these animals.

The Service recognizes the management objectives and guidelines set forth in the ADF&G wildlife management plans for deer, mountain goat, furbearers, small game, waterfowl, and unclassified game. The Service will work with ADF&G to manage these populations in accordance with these guidelines, so long as the management actions are compatible with the purposes of the refuge.

(b) Fisheries Management

The Service is proposing to take several actions for all of the alternatives to achieve the purposes of the refuge with respect to refuge fisheries. These tasks are noted throughout the common management directions; they are also listed in Table 16. Additional tasks apply to specific alternatives, and are listed under the appropriate alternative.

Table 16. Common fishery management tasks for all of the alternatives.[a]

The Service will:

- work with the state to maintain the refuge's water quality and fish habitats.
- protect and maintain the physical and biological qualities of the rivers and adjacent refuge lands, including water quality and fisheries.
- protect spawning areas and water quantity and quality to ensure that the fish habitats remain in optimum condition.
- support investigations to upgrade total returns of sockeye to the Karluk Lake system.
- continue to investigate reasons for the decline of Karluk Lake's sockeye salmon.
- continue to support ADF&G efforts to evaluate the aquatic impacts of the Terror Lake hydroelectric facility.
- support any ADF&G efforts to tag sockeye salmon in bays outside of the refuge to determine their terminal destination.
- continue to support, and if needed assist, ADF&G efforts to evaluate the success of pink salmon reproduction throughout the refuge.
- conduct studies to determine the locations, extent of habitat use and population characteristics of steelhead and chinook salmon on the Ayakulik/Red River.
- support the use of existing fish counting weirs, the Dog Salmon Creek fish pass, the egg-take and incubation facility on the Thumb River, and a temporary sonar array below the outlet of Frazer Lake.
- conduct or assist in aerial surveys on approximately 89 refuge streams to index salmon escapement levels.
- monitor, when necessary, wildlife use of refuge-based salmon stocks to ensure adequate densities of salmon for wildlife use.
- conduct investigations to determine aerial indexes of angler use on selected major river system in the refuge.
- monitor the effects of commercial, recreational and subsistence activities on refuge fishery resources.

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[a] There are several public use common management directions that would affect fishery programs but which are not listed here.

In addition to the research/management studies and monitoring projects noted earlier in this chapter, in all of the alternatives the Service will support:

- the sport fish, finfish and subsistence regulations of ADF&G;
- the concept of optimum sustained yield with respect to fish harvests;
- the use of existing fish counting weirs on the Ayakulik/Red, Dog Salmon, Karluk and Upper Station drainages, a fish pass on the Dog Salmon Creek below Frazer Lake, and a temporary sonar array below the outlet of Frazer Lake to estimate numbers of sockeye smolt leaving the lake each year;
- the protection of water quality that will provide conditions consistent with natural processes and not exceed those standards set forth in the Alaska Department of Environmental Conservation's water quality standards or have a detrimental effect on the abundance or diversity of anadromous or resident fish species.

Chinook salmon, one of the species most sought after by anglers on the refuge, is a national species of special emphasis.

In all of the alternatives the Service will provide a high level of protection to major and minor drainages that sustain both resident and anadromous fish species. The Service will take particular care to ensure a minimum of disturbance to habitats in these drainages that is vital to individual species or sensitive to disturbance (e.g., spawning and rearing areas or migration routes). The Service will also maintain water quantity and quality to ensure that the fish habitats remain in good condition. Before permitting any activity on the refuge, the potential impacts on fish habitats and populations will be carefully weighed.

Under all of the alternatives the Service will support investigations to upgrade the sockeye fishery in the Karluk Lake system. Investigations will continue to evaluate the survival of planting up to 8 million eyed sockeye salmon eggs in the Thumb River and total fry production from egg plants. Migrating fry from the egg plants will continue to be tagged to track juvenile sockeye survival in the system. The feasibility and effects of of fertilizing Karluk Lake are currently being evaluated; this evaluation will have been completed prior to the development of the final CCP.

Investigations will continue to determine the causes for the decline of sockeye salmon in the Karluk Lake system. A predator/prey investigation will be continued to evaluate the impact of Dolly Varden and Arctic char on juvenile sockeye salmon in Karluk Lake. Investigations of sticklebacks as competitor species and coho salmon and Dolly Varden as predator species will be continued at Karluk, Thumb and O'Malley lakes and the Karluk River. A genetic analysis of sockeye salmon stock will be continued and spawning ground surveys will be conducted for all tributaries of Karluk Lake. A smolt production estimate will be made using an instream trap, and mark and recapture methods.

National and Regional Species of Special Emphasis - Three national species of special emphasis (chinook salmon, coho salmon and steelhead trout) and one regional species of special emphasis (sockeye salmon) occur on Kodiak Refuge. Although all of the salmon species occur on other Alaskan refuges, steelhead trout only occur in abundance on Kodiak Refuge. The Service has developed several general management strategies for each of these fish species in its Alaska Regional Resource Plan. The strategies relevant for refuges, such as conducting studies to determine migration, spawning, rearing and overwintering habitats and population characteristics, are reflected in the management directions developed for the Kodiak Refuge Comprehensive Conservation Plan. Specific actions that may need to be taken on the refuge will be addressed in future management plans.

Fish Population Objectives - Under all of the alternatives the Service's goals are to maintain habitat conditions at a level sufficient to continue supporting fish populations at current or calculated historic levels, and to maintain self-sustaining native fish populations at current or calculated historic levels. Each of the alternatives includes salmon escapement and index goals and annual harvest goals. The Service developed these goals in cooperation with ADF&G. The Service will assist ADF&G's efforts to meet these goals, provided the proposed management actions are compatible with refuge purposes. As more population data becomes available for other fish species, such as rainbow trout and char, the Service will, assist and cooperate with ADF&G in setting goals consistent with available habitat. The Service will also provide data and assist ADF&G in refining population objectives where updates are needed for the state to effectively manage the commercial, sport and subsistence fisheries.

(c) Water Quality

All facilities and activities on the refuge will comply with the pollution control standards set by the Clean Water Act, the Federal Water Pollution Control Act Amendments, and all other applicable state and federal laws, regulations, and orders governing air and water quality. The Service will cooperate with the Alaska Department of Natural Resources (Division of Land and Water Management), Alaska Department of Fish and Game (Habitat Division), Alaska Department of Environmental Conservation, and other appropriate agencies responsible for establishing and enforcing water quality standards, and is empowered to set its own standards if needed to protect fish and wildlife.

Water quality parameters for most of Kodiak Refuge are unknown. The Service, working with the state, will develop a water resource management plan which will include important water quality measurements. It is essential to collect baseline data as soon as feasible so that changes due to human activity can be documented and corrected. The Service may cooperate with adjacent landowners in collecting these data.

Important sampling sites for collecting baseline water quality data include streams and lakes near sources of potential pollution on or near the refuge. Present or future developments that may impact water quality include set net sites, fish processing facilities, administrative sites, public use cabins, and private camps or cabins. Habitat manipulation can also affect water quality and quantity.

Water quality measurements should be taken around times of low flow. Both water and sediment should be collected. To ensure that the results have legal standing, sampling programs will be designed and carried out and analyzed by Service-approved agents. Important parameters to measure in all samples include: temperature, pH, conductivity, alkalinity, hardness, suspended solids (turbidity) and settleable solids (sediment). Other parameters to measure depend on the suspected sources of pollution, but include levels of: at least ten heavy metals, petroleum hydrocarbons, several nutrients, dissolved gases, and fecal coliform bacteria.

Selected fish and wildlife also should be tested for accumulated contaminant levels if pollution is suspected. Some important indicator species are filter-feeders such as freshwater clams, and predators such as salmonids, bald eagles, and brown bear.

Refuge staff will advise adjacent landowners to ensure awareness of potential pollution threats and to coordinate protection of water quality among all concerned parties. Any pollution of refuge waters will be reported to appropriate state and federal agencies.

(d) Water Rights

The water resources of Kodiak Refuge will be managed to maintain the primary purposes of the refuge, as stated in Section 303(5)(B) of ANILCA, and in other statutory mandates. Specific water resource requirements for the primary purposes of the refuge will be identified and the minimum amount of water reasonable necessary to mantain these purposes will be quantified in cooperation with the State of Alaska. Once federal reserved water rights have been quantified, the Service will file this information with the state in accordance with state law. Water for secondary purposes and all other uses will be applied for under Alaska Statutes (AS) 46.15.

Following adoption of the comprehensive conservation plan for Kodiak Refuge, a water resource management plan will be prepared. This plan will identify streams and lakes whose protection has highest priority and will outline procedures for quantifying their flow. The Service will cooperate with the state in obtaining these data.

Instream flow studies will investigate the full annual range of flow, as both flood and low-water stages are essential in the life cycles of wetland species. Extreme flood and drought years also will be included in the analysis, as both are important to the renewal of aquatic habitats. Once year-round instream flow requirements have been quantified, the Service will continue to monitor streams that may be subject to modification outside the refuge. The Service will contact other water users if the Service determines that a proposed project threatens refuge waters or wildlife. Reductions in instream flows below the federal reserved right will be reported to the appropriate state or federal agencies so action can be taken to maintain refuge instream flows.

(e) Navigable Waters

All navigable waters (and submerged lands beneath these waters) are under the jurisdiction of the Fish and Wildlife Service. As a refuge established prior to statehood, all waters in Kodiak Refuge that are determined to be navigable are retained in federal ownership.

(f) Air Quality

All activities on the refuge will comply with the Clean Air Act, as amended, and all other applicable state and federal laws, regulations and orders. The Service will cooperate with the Alaska Department of Environmental Conservation and other appropriate agencies responsible for establishing and enforcing air quality standards.

(g) Visual Resources Management

In all alternatives the Service will identify and maintain the scenic values of the refuge and minimize the visual impact of developments. Refuge facilities and commercial use support facilities will be designed to blend into the landscape. The Service will cooperate with state agencies to prevent any significant deterioration of visual resources.

(h) Fire Management

The Alaska Interagency Fire Management Plan for the Kodiak/Alaska Peninsula planning area provides direction for fire suppression in the refuge. This plan was completed by representatives of the Service, Bureau of Land Management, Bureau of Indian Affairs, ADF&G, the Alaska Department of Natural Resources (the agency that actually suppresses fires in the area), Koniag Corporation, and other village corporations.

Fires in Kodiak Refuge will be allowed to burn naturally where not endangering life or property. If fire suppression becomes necessary, state-of-the-art techniques and the "minimum appropriate tool" concept will be used. Private lands within or adjacent to the refuge, conveyed and selected Native lands and allotments, and refuge administrative and public use facilities will receive the maximum protection practicable from fires. (Refer to the fire management plan for detailed discussions on wildland fire ecology and management, suppression options, and environmental assessment.)

(i) Historical/Cultural Resources

All significant historic, archeological, paleontological, and cultural resources on the refuge will be protected as required by law. Before doing anything that would alter historic structures or disturb the ground, the Service will survey the site to determine if cultural resources are present. Private interests proposing to conduct economic activities on the refuge will be required to fund these site-specific surveys. If cultural resources are discovered, their importance will be evaluated to determine their eligibility for inclusion in the National Register of Historic Places. A determination of appropriate action will be made (e.g., avoidance, partial or total mitigation through salvage, site hardening). All of these actions will be taken in consultation with the Regional Historic Preservation Officer, State Historic Preservation Officer, the Advisory Council on Historic Preservation and other appropriate agencies.

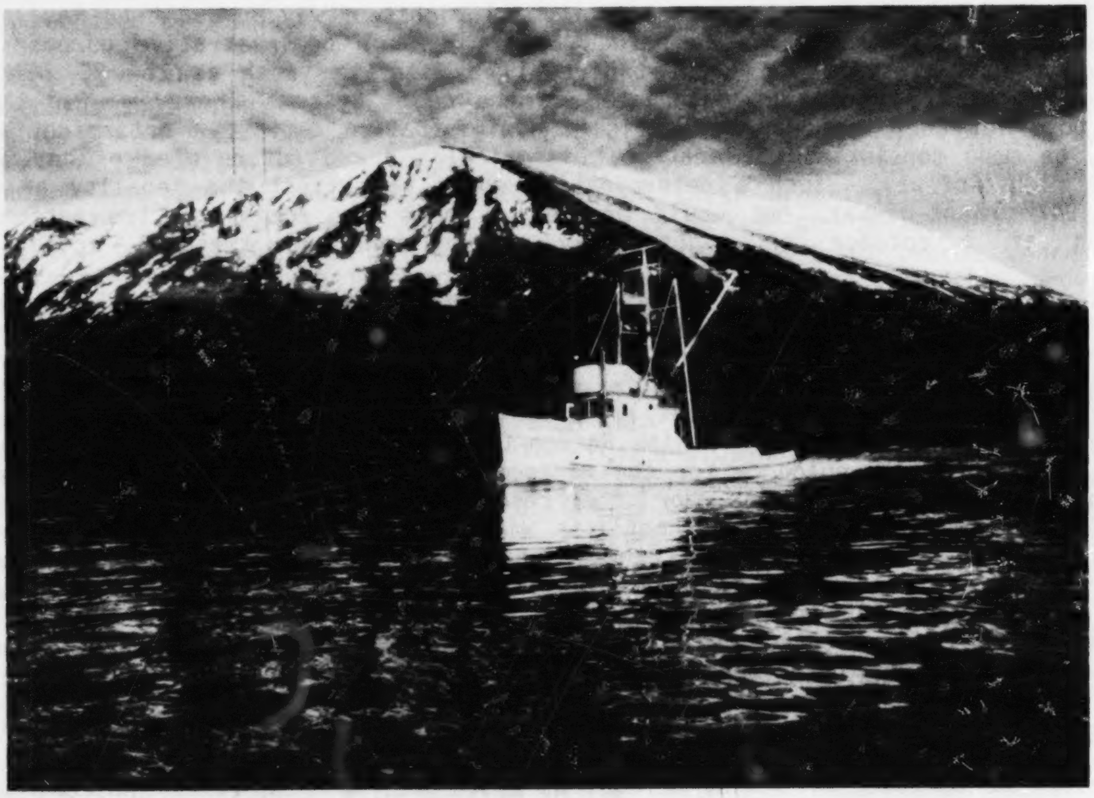
The 1980 Amendments to the National Historic Preservation Act also direct the Service to inventory and evaluate the cultural resources on the refuge. Qualified social scientists may be encouraged to undertake surveys and research on the refuge to assist the Service in this effort (see also the research common management direction).

10) Public Access Management Directions

In all of the alternatives reasonable access onto the refuge will be ensured so visitors can participate in wildlife-oriented recreational activities. Under all alternatives non-motorized access will be encouraged. The use of snowmachines, motorboats, airplanes, and non-motorized surface transportation methods for traditional activities is permitted on the refuge under Section 1110(a) of ANILCA. Although these activities are subject to reasonable regulations to protect the natural and other values of the refuge, they cannot be prohibited unless it is determined that they would be detrimental to the resource values of the refuge. No areas will be closed to the above transportation methods until after notice has been given and the Service has held public hearings in the vicinity of the refuge.

In all of the alternatives the use of snowmachines, fixed-wing aircraft landings, and jet boats will be regulated to protect resource values. Snowmachine use will be limited to periods of adequate snow cover, and prohibited in key brown bear denning habitat. In these areas snowmachine disturbance could adversely affect bears. Of particular concern would be disturbance to females with newborn cubs. Female abandonment of dens for more than 3 to 4 hours may result in cub mortality.

Fixed-wing aircraft with wheels or skiis will be permitted to land only on frozen waterbodies and coastal beaches. Landings of aircraft on other areas would markedly increase access into remote areas. This would directly affect bears by increasing hunter success and indirectly affect them through displacement and bear/man conflicts. This in turn could affect the Service's brown bear population objectives.



Boats are often used by local residents to gain access to coastal portions of the refuge, such as Spiridon Bay.

The commercial and recreational use of helicopters and all-terrain vehicles will be prohibited throughout the refuge in all of the alternatives. The broad access capabilities offered by these vehicles would clearly increase levels of human activity in remote areas of the refuge's interior, and would seriously reduce the quality of brown bear habitat. State statute also prohibits use of helicopters for transporting hunters or their gear.

None of the alternatives would permit the development of roads or air strips for public access. No groups have identified the need for these facilities. Roads and airstrips also would significantly increase access into the refuge, which in turn has the potential to adversely impact the refuge's brown bear and other fish and wildlife populations.

In accordance with Section 1110(b) of ANILCA, the state and private interests with valid surface or subsurface rights on or surrounded by Kodiak Refuge are entitled to adequate and feasible access across the refuge. Such access may be subject to regulations to protect the resource values of the land or to protect public health and safety.

Transportation rights-of-way that have historically been used on refuge lands are another concern to both the Service and the state. The Service will work cooperatively with the state to identify all rights-of-way pursuant to Revised Statutes (RS) 2477 within the refuge boundaries for administrative purposes. When rights or title are granted directly by statute, such as the RS 2477, these rights can only be adjudicated in the court system. However, for the purposes of carrying out the Service's administrative duties, a determination may be made consisting of location, historical use and future need of any of the rights-of-way. Such a determination would not affect the legality of a RS 2477 right-of-way, but would provide a basis for administrative actions such as acceptance of right-of-way applications or trespass actions.

Under Section 17(b) of the Alaska Native Claims Settlement Act (ANCSA), the Bureau of Land Management (BLM) reserved easements for access across Native corporation lands to the refuge. These easements are for access purposes only. Nonexclusive use easements may be reserved by BLM across Native allotments when trails or areas of prior established public use overlap an allotment application. The Kodiak Refuge Comprehensive Conservation Plan does not provide policy guidance for the management of 17(b) easements, the use of nonexclusive use easements, or the resolution of conflicts with Native allotments when the allotment conflicts with public use values. The Service will develop policies to address these management concerns prior to developing a land protection plan or taking other specific actions affecting use of 17(b) easements or areas where public use areas conflict with private inholdings. The Service will work with the State of Alaska and other interested parties in the development of these policies.

11) Subsistence Use Management Directions

One of the purposes of Kodiak Refuge, as described in Title III of ANILCA, is to provide the opportunity for continued subsistence uses by local residents. Title VIII of ANILCA further provides that rural Alaskan residents engaged in a subsistence way of life be allowed to continue using refuge resources for traditional purposes. Subsistence uses on the refuge will be given preference over other consumptive uses when restrictions on harvests are necessary to assure the continued viability of fish and wildlife populations.

Title VIII authorizes the state to manage subsistence uses of fish and wildlife on federal lands if it enacts and implements laws to provide for subsistence preference and if it assures local involvement in management of subsistence resources. On May 14, 1982, the Secretary of the Interior notified the state that its program for subsistence management and use complied with requirements of ANILCA. Thus the state is responsible for administering certain subsistence provisions of ANILCA. The Service will support the state in meeting those responsibilities under all alternatives. The taking of fish and wildlife for subsistence and other purposes on Kodiak Refuge will be as prescribed by regulations established by the Alaska Boards of Fisheries and Game.

Although the state's program for subsistence management and use generally governs subsistence uses of fish and wildlife on the refuge, other duties remain vested in the Department of the Interior. Among the most important of these statutory duties are those required by Section 806. Under all alternatives the Service will monitor both the status of fish and wildlife populations harvested for subsistence uses and the state fish and game regulatory system. This monitoring is intended to identify potential problems related to allocation of resources before populations of fish and wildlife become depleted, and to ensure that preference is given to subsistence users as required by law.

The Service has developed with the state and other federal land management agencies subsistence monitoring guidelines. The Service will participate in a cooperative subsistence monitoring effort with ADF&G, the local fish and game advisory committee, the regional council, and the Boards of Fisheries and Game. The Service will attend meetings of these organizations to provide information on the status of subsistence resources and management of the refuge, to identify data needs related to subsistence, to become aware of concerns regarding subsistence uses and refuge programs, and to provide comments to the boards on regulatory proposals that affect subsistence uses of fish and wildlife on the refuge.

The Service will also evaluate the effects of proposed actions on subsistence use under all alternatives in compliance with Section 810 of ANILCA. When a decision is to be made on "whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition" of refuge lands, the Service will evaluate the effect of the proposed action on subsistence uses and needs, note the availability of lands for the proposed activity, and consider other alternatives to the proposed action. The Service will work with ADF&G and with other appropriate local sources in determining whether a proposed action "significantly restricts" subsistence uses. If a proposed action would probably adversely affect subsistence use, then the Service will follow the formal procedures specified in Section 810 before further consideration of the proposed action.

Access to refuge lands by traditional means will be permitted for subsistence purposes in accordance with Section 811 of ANILCA. Traditional means, as defined in Service regulations (50 CFR 36), include snowmachines and boats (excluding air boats) on Kodiak Refuge. Use of snowmachines will be limited to periods of adequate snow cover and prohibited in key brown bear denning areas.

Under Section 816 of ANILCA, the Service may close the refuge to the taking of fish and wildlife if necessary for reasons of public safety, administration, or to assure the continued viability of particular populations of fish or wildlife. Except in an emergency, such closure will follow consultation with the state, adequate notice, and public hearings. In an emergency situation, the Secretary may immediately close the refuge. Emergency closure to subsistence taking would occur only after all other consumptive uses are eliminated.

Although Titles III and VIII of ANILCA require the Service to maintain opportunities for, and give preference to, subsistence harvest of fish and wildlife on the refuge, these requirements are subject to all other laws governing management of particular species or species groups.

12) Public Use Management Directions

(a) Recreation Management

Recreational (non-subsistence) hunting, fishing, and trapping, as well as other wildlife-oriented recreational activities (e.g., hiking, primitive camping, photography, wildlife viewing, river rafting, cross-country skiing) will be allowed throughout most of the refuge under all alternatives. The Service will continue to support compatible wildlife oriented recreation on the refuge. Nonconsumptive recreation is recognized as an increasingly important part of the refuge's public use program.

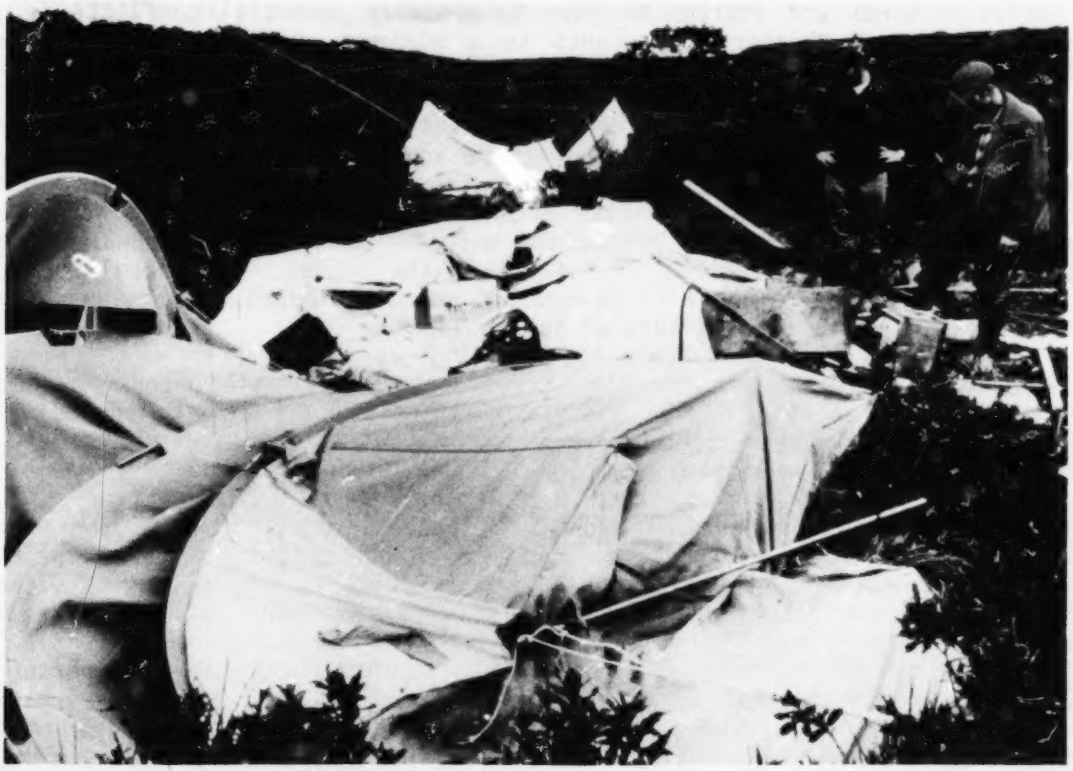
The Service will manage the refuge, particularly the Ayakulik/Red River, to avoid overcrowded conditions and minimize adverse impacts to historical/cultural, fish and wildlife, and other special values. Actions that may be taken to minimize impacts include regulating access (subject to the provisions of Section 1110(a) of ANILCA), recommending changes in state hunting or fishing regulations to ADF&G, limiting use of the refuge's public cabins, limiting commercial sport fish guiding and outfitting activity, and encouraging through interpretive and educational programs user behavior that is sensitive to wildlife and wildland resources.

Recreational use by unguided visitors will be managed through informational programs and voluntary compliance. Unguided groups will be encouraged to check with the Service before entering the refuge. Backcountry permits eventually may be required for all recreational groups. In all of the alternatives regulations may be promulgated on a seasonal or area-specific basis with regards to how long groups in tents can stay at at one location. This action would be taken to minimize potential conflicts with bears, to disperse use and thus reduce other potential resource impacts, or to ensure that other users have an opportunity to use an area. Bear hunters will be permitted to camp at one location for a longer period than other groups in recognition of the relatively short bear hunting season, and the limited number of bear hunters distributed over a large area. The need for specific camping time limits will be addressed in the recreation management plan.

Other direct restrictions of use, such as limiting numbers of users in an area or limiting the number of boat launches for river trips on peak days, will be avoided unless voluntary methods fail. Commercial recreational use (i.e., guided groups) will be regulated by permits or concessions, as required under Service regulations (see the guiding common management direction).

(b) Education/Interpretation

The success of most of the management activities outlined in this plan will depend to a large extent on the actions of refuge users, adjacent landowners, local residents, and other interested citizens. An effective educational/interpretive program will help avoid potential problems by increasing public understanding of and support for refuge management goals and actions.



To avoid potential bear-human conflicts the Service will educate visitors on avoiding bear travel routes and seasonal concentration areas, and on proper storage and disposal of food and garbage.

Educational and interpretive programs prepared by the refuge staff will emphasize the dependence of the refuge's wildlife on undisturbed wildlands and particularly the resources of the sea. These programs, as well as leaflets and audio-visual programs, will demonstrate why Kodiak's climate, vegetation, marine and aquatic resources are all responsible for supporting the largest land carnivore in the world.

As noted in the wildlife common management direction, bear/human conflicts are of concern in Kodiak Refuge. Human activity is anticipated to continue to increase in the future. Use of the refuge's public cabins is high, the level of deer hunting continues to increase, and demand for commercial sport fish guiding has dramatically accelerated in the past two years. Increasing human use and habituation of bears to areas of high or consistent use (e.g., sport fish and deer hunting camps, village garbage dumps, favored photography areas) creates the potential for bears being killed in defense of life and property (DLPs). An increasing number of DLPs could have long-term effects on the bear population (McCullough, 1982; Jope, 1985). The Service will concentrate its efforts on educating all refuge visitors and adjacent landowners about the potential problems and actions to take to minimize potential conflicts (e.g., keeping garbage and other attractants to a minimum, avoiding salmon streams and other bear travel routes).

Another potential problem concerns the private inholdings and Native lands adjacent to the refuge: the actions of these landowners can affect the refuge, while refuge visitors may inadvertently trespass on private lands. The Service will concentrate its initial efforts on informing adjacent landowners and local residents about the refuge and ensuring that users are aware of and respect private lands adjacent to and within the refuge. A general brochure on the values of the refuge will be updated and distributed. This should help reduce trespass by refuge visitors on Native lands.

Because most visitors depend on air taxi operators and transporters, and many depend on guides and outfitters, a special effort will be made to periodically contact commercial operators. This action will enable the commercial operators to better inform their clients of Service programs.

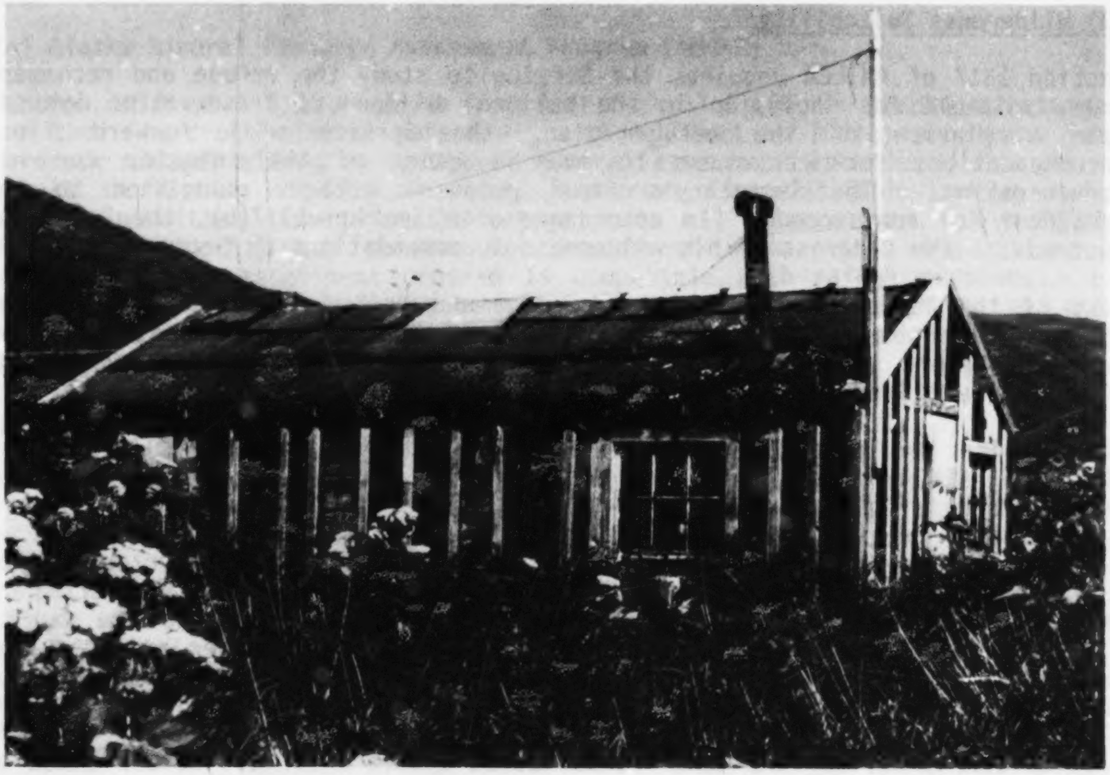
In the future, the Service will expand its education/interpretive program for Kodiak Refuge. Brochures, posters, and similar publications will be prepared to inform visitors about recreational opportunities on the refuge and about special areas, such as spawning, nesting/staging and bear feeding and denning areas. Existing refuge visitor contact facilities in Kodiak and the planned interagency center in Anchorage will enable users to meet Service personnel and learn about the refuge. The Service will focus its environmental education efforts in assisting teachers in Kodiak and other villages in the Kodiak Refuge area. All of these actions should increase local residents and visitors awareness and understanding of the local environment, the refuge, and the Service's management programs.

(c) Cabin Management

Nine public use cabins are on Kodiak Refuge; two additional public use cabins on the Karluk River are on Native lands and are now the property of the village corporation. The refuge cabins are intended to provide the public with an unique opportunity to enjoy and use the refuge in relative comfort.

They also help ensure public safety due to bad weather and bears. In all of the alternatives the Service will maintain at least five of the refuge cabins: at Uganik Lake, Uganik Island, Little River Lake, Viekoda Bay, and Chief Cove. The other four cabins, on Frazer Lake (2), Red Lake, and O'Malley Lake, may be maintained depending on the alternative. New public recreation cabins or administrative cabins may be provided in the refuge, depending on the alternative. The Service will also consider building meat caches by the cabins to reduce the potential for DLPs.

The Service uses a lottery to determine who can use the cabins. Drawings for reservations are held in January, April, July and October. An individual or group may only reserve any cabin up to seven days within one calendar year. A $10 administrative fee will be charged per day for use of a cabin to help cover the cost of providing this service.



The Red Lake public use cabin.

About 22 commercial fishing cabins and 5 guide cabins are permitted on public lands within Kodiak Refuge. These cabins are permitted solely for supporting commercial activities. Fish and Wildlife Service regulations on existing cabins within Alaskan refuges (50 CFR 36.33(b)(1) state that traditional and customary uses of these cabins (e.g., commercial guiding, commercial fishing) will be allowed to continue if the Service determines the uses are compatible with the purposes for which the refuge was established; renewable, five-year special use permits shall be issued for these existing cabins. Under all of the alternatives commercial fishing and guiding operators with existing valid permits will continue to be permitted to use their cabins in support of their operations (see also the commercial fishing and guiding common management directions). Existing commercial use cabins may be replaced with new cabins, subject to use and size restrictions as stipulated in the permitee's special use permit. No permits shall be issued to authorize the use of a cabin for private recreational use. Maintenance of existing cabins on refuge lands is the responsibility of the permitted owner.

Under Section 1303 of ANILCA, the construction of new cabins for private recreational use on Kodiak Refuge is prohibited.

13) Wilderness Suitability

Section 1317 of ANILCA requires the Service to study the refuge and recommend areas suitable for inclusion in the National Wilderness Preservation System. Upon completion of the refuge plan, the Service will forward final recommendations for wilderness to the Secretary of the Interior for his consideration. The Secretary's final proposal will be submitted to the President for concurrence. In accordance with Section 1317(b), the President must advise the Congress of his wilderness recommendations by December 2, 1987.

Most of the lands designated for minimal management in each alternative for Kodiak Refuge would be suitable for wilderness designation. Not all of these lands, however, are proposed for wilderness designation in the management alternatives.

The Service was guided in developing its wilderness proposals by Section 101(d) of ANILCA, which states that:

> This Act provides sufficient protection for the national interest in the...public lands in Alaska, and...provides adequate opportunity for satisfaction of the economic and social needs of the State of Alaska and its people: accordingly, the designation and disposition of the public lands...pursuant to this Act are found to represent a proper balance...and thus Congress believes that the need for...designating new conservation systems...has been obviated...

Section 102(4) defines the term "conservation system unit" to include units of the National Wilderness Preservation System.

Consistent with the intent of Section 101(d), the Service used two criteria in developing the wilderness proposal for its preferred alternative. Lands were proposed for wilderness designation if they are adjacent to existing wilderness area boundaries and logically belong in the wilderness area but have not been designated as wilderness (e.g., adjustments to the wilderness boundary that would incorporate an entire watershed or drainage basin into the wilderness area). Lands were also proposed if they have outstanding resource values that were overlooked by Congress in the ANILCA wilderness designations. In all cases, the federal government must own both the surface and subsurface rights of these areas: only lands where the federal government owns both the surface and subsurface rights can be considered for wilderness designation.

The Service's wilderness proposal for Kodiak Refuge ranges from none of the refuge in Alternative A to all of the refuge lands in Alternative D. Under the preferred alternative, Alternative C, about 1,074,000 acres (435,000 ha) in the Ayakulik/Uyak and Zachar/Uganik wilderness review units would be proposed for wilderness designation (see Figure 37).

14) Economic Use Management Directions

(a) Alaska Mineral Resource Assessment Program (AMRAP)

Section 1010 of ANILCA requires that all federal lands in Alaska be assessed for their hardrock mineral potential, although Section 304(c) prohibits "new" hardrock mineral mining on refuges. Mineral assessment techniques that do not result in lasting impacts on refuge resources, such as side-looking radar, will be permitted throughout the refuge under all alternatives. The Service will issue special use permits for assessment work, with stipulations to ensure that the assessment program is compatible with refuge purposes. For example, stipulations may limit access during nesting, spawning, or other times when fish and wildlife may be especially vulnerable to disturbance.

(b) Oil and Gas Exploration and Development - Section 1008 National Interest Determination

The Service has developed a policy on oil and gas exploration and leasing on Alaska refuges that reflects Section 1008 of ANILCA. This policy is included as Appendix N.

As noted in Chapter V, Kodiak Refuge has little or no identified potential for oil or gas reserves. The Bureau of Land Management will assess the oil and gas potential of the refuge and viability of development. The Service will also consult with the Secretary of Energy, as required in Section 1008(2) of ANILCA, regarding the national interest in exploring for oil and gas on Kodiak Refuge.

Exploration - Oil and gas exploration, including seismic exploration, will be permitted throughout Kodiak Refuge on a case by case basis, subject to a determination of compatibility with refuge purposes and consistency with the management objectives adopted in the CCP. All of the refuge, including the designated minimal management areas and proposed wilderness areas, will be open to oil and gas exploration under these conditions. However, no exploratory activities will be permitted on the refuge prior to the issuance of a record of decision.

Leasing - Under Section 1008 of ANILCA, oil and gas leasing can occur on Alaska refuges if it is determined that these activities are compatible with the purposes for which the refuge was established. A 1982 Memorandum of Understanding between the U.S. Department of Interior, U.S. Department of Agriculture, and the State of Alaska states that the refuge comprehensive conservation plans will be the vehicle used to determine if oil and gas exploration and development should be permitted on Alaska refuges.

Consistent with the Service's Section 1008 oil and gas policy, in minimal management areas common to all of the alternatives oil and gas development has been determined by the Service to be incompatible with the purposes for which Kodiak Refuge was established. This determination was based on the sensitivity of such key refuge species as brown bear, tundra swan, bald eagles, and salmonids, to disturbance. Many studies indicate that human activities can adversely affect these species. It has been clearly demonstrated that brown bear are adversely affected by increasing levels of human development and activity (Cowan, 1972; Stebler, 1972). Tundra swan have been documented as being extremely sensitive to disturbance during the nesting, incubation, brood rearing and molting periods in Izembek National Wildlife Refuge (refuge staff, pers. comm.). Nesting bald eagles, while known to exhibit a wide range of tolerance to the presence of human activity, can be easily displaced from traditional sites (Hensel and Troyer, 1964; Corr, 1978). Salmonid eggs and fry are subject to high mortality levels with changes in water quality (Bell, 1973).

Human use on Kodiak Refuge is expected to increase substantially over the next ten years. Increasing recreational use, including hunters, anglers, photographers, will affect the refuge's fish and wildlife. Oil and gas exploration and production activities, including development of roads, pipelines, airstrips, work camps, well pads, increased industrial traffic, and provision of support services, would have additional effects on fish and wildlife. The cumulative effects of petroleum development would pose a serious threat to maintenance of the refuge's fish and wildlife resources. This is particularly important considering the relatively small areas of the refuge with key habitat, the lack of replacement habitat, and the extreme interdependence of commonly shared habitats among brown, bear, eagles, swan, and salmonids. The similarities and interties among habitats and habitat requirements for many of the refuge's fish and wildlife populations strongly suggest that intensive and extensive industrial development would result in major adverse physical and behavioral impacts to existing populations.

In the rest of Kodiak Refuge, where adequate information on oil and gas potential is lacking, leasing will not be considered until the oil and gas potential of the refuge has been assessed, a compatibility determination has been completed, and a national interest determination has been made. No formal leasing program will be initiated prior to the issuance of the record of decision, and a determination is made that leasing would be in the national interest, as called for in Section 1008. When these steps have been completed, the plan may be modified to permit leasing, subject to reasonable regulation. If this occurs, the Service would revise the plan in compliance with the NEPA process, providing opportunities for public involvement.

(c) Commercial Air Taxi Businesses and Marine Transporter Businesses

Most recreational visitors use air taxis or boats to go from the city of Kodiak to the refuge. In all of the alternatives commercial air taxi operators and marine boat transporters taking people into the refuge would be required to obtain special use permits from the Service, under 50 CFR 27.97. In March of 1985 the Service's Alaska regional office issued a policy directive to clarify questions and inconsistencies on issuing special use permits for commercial activities. The air taxi and marine transporter permits will give the Service a better idea of the level of use in the refuge. The permits also could be used to regulate the number of visitors using parts of the refuge if the level of use increases in the future to the point that serious resource problems are identified.

(d) Commercial Guiding and Outfitting

In 1984, 15 big game guides, 11 sport fishing guides, and an estimated 5 outfitters took clients into Kodiak Refuge. Big game hunting guides and their guiding areas are regulated by the Alaska Guide Licensing and Control Board. In addition, all big game hunting guides, as well as all commercial sport fishing guides and outfitters, are required under 50 CFR 27.97 to obtain special use permits to operate on the refuge. These permits are issued annually, and authorize the guides and outfitters to operate in the refuge for an agreed upon time period. The Service will attach conditions to these permits to ensure that the guides' and outfitters' camps, travel methods, and activities are consistent with the selected alternative. In addition, under 43 CFR 2650.1(a) and a December, 1981 Service policy directive, guides and outfitters must have a letter of concurrence from the village corporations to use Native selected lands within the refuge boundary.

Stipulations would be included in the permits issued to both guides and outfitters to help reduce the potential for resource impacts. Kodiak Refuge has only a limited number of access points and good camping sites. Consequently, both guided groups and outfitted groups using tents may be limited in how long they can camp at at one location. This action would be taken to minimize potential conflicts with bears, to disperse use and thus reduce other potential resource impacts, or to ensure that other users have an opportunity to use an area. Bear hunters will be permitted to camp at one location for a longer period than other groups in recognition of the relatively short bear hunting season, and the limited number of bear hunters distributed over a large area. Other stipulations could cover such items as groups size, food storage, garbage disposal, and minimum impact camping practices. The need for specific camping time limits and other stipulations will be addressed in the recreation management plan.

In all of the alternatives guides and outfitters would be permitted to use tents on the refuge. No new permanent structures, such as cabins, would be permitted. The alternatives vary on whether new temporary facilities, such as tent frames/platforms, would be permitted for the season of use.

Under all of the alternatives the Service will monitor the number and type of guides and outfitters operating in the refuge and will, if necessary, regulate use. In the future it may become necessary to limit the amount of guided day use on the refuge's rivers. These limits would be intended to protect the

In 1984, fifteen big game guides took about 100 brown bear hunters into the refuge.

the refuge's resources and reduce the potential for bear/human conflicts. If problems arise relating to guided or outfitted parties, such as conflicts with subsistence use, violations of conditions in the permits, or violations of harvest regulations, the Service will work with the operator(s), and other appropriate groups, such as local landowners and the state, to resolve the situation.

If it becomes necessary to limit guiding or outfitting in the refuge the Service reserves the right to revoke the temporary permits it has issued after the permits expire. Permits may be allocated to sport fish guides and outfitters on the basis of several criteria. These criteria may include: history of past use on the refuge and other public lands; financial responsibility (i.e., being able to show the operator has sufficient funds to operate a safe, quality business); knowledge of the area; level of experience; duration of use in the year; and record of compliance with refuge rules and regulations. Other factors that would be considered in regulating use levels in specific areas would include the relative accessibility or remoteness of proposed camps; availability and demand for the resources in the immediate area; availability of comparable services on adjacent private lands; and proximity to seasonal brown bear concentrations. The Service will work with the operators and the state to ensure that the allocation of permits is done fairly and equitably.

(e) Commercial Fishing Support Facilities

Commercial fishermen have for many years fished for salmon from the beaches of Kodiak Refuge. There are 31 set gillnet fishing sites on refuge lands and 34 set-gill net sites on Native lands under special use permit within the refuge boundaries. Under Section 304(d) of ANILCA the Service will continue to permit individuals with valid commercial fishing rights or privileges to operate on the refuge. The use of campsites, cabins, motorized vehicles and aircraft landings on refuge lands in support of commercial fishing are subject to reasonable regulation. Only the minimum human presence necessary for commercial fishing will be permitted.

In 1984, there were 22 permanent commercial fishing support facilities (i.e., cabins), 8 temporary facilities (i.e., tent frames/platforms), and part of a cannery on lands under the Service's jurisdiction. Another 32 permanent commercial fishing support facilities, 2 temporary facilities, and part of a cannery are on Native lands within the refuge boundary. Commercial fishermen with valid permanent facilities will continue to be permitted to use these facilities for commercial fishing; the facilities are permitted solely for this purpose unless otherwise specified. No new permanent facilities will be permitted on the refuge. However, the replacement of existing permanent structures may be permitted. In all alternatives new temporary facilities may be installed in the moderate management areas. All temporary facilities must be dismantled after the season of use, but may be stored on-site. Off road vehicles (ORVs) will not be permitted at commercial fishing sites above the mean high tide line (i.e., the refuge boundary).

Section 304(d) specifies that commercial fishing rights may not be granted if the use is determined to be inconsistent with the purposes of the refuge and a "significant expansion" of commercial fishing activities beyond the level that occurred in 1979. The permitted size and number of commercial fishing support facilities will be in strict accordance with what is needed to conduct a viable commercial fishing operation. Expansion of existing facilities, such as building small ice-making facilities, may be permitted if necessary for economic reasons or to satisfy industry requirements. Expansion of the fishing season to include the fall silver salmon run also may be permitted. On the other hand, development of processing facilities, such as a saltery, or opening of a new fishery, such as herring, halibut or crab, would not be permitted because they both pose potential adverse impacts to the refuge's resources and constitute a significant expansion of the fishing activity.

(f) Transportation and Utility Systems

Under Title XI of ANILCA, transportation and utility systems could be constructed on or across Kodiak Refuge under all alternatives. Any proposed system would be evaluated to determine its potential environmental impacts. The transportation system would be permitted if it is determined that the system would be compatible with the purposes for which the refuge was established and there is no economically feasible and prudent alternative route for the system. Restrictions may apply on the methods of transmission/pipeline placement.

(g) Other Economic Uses

Public Land Order 1634, issued on May 9, 1958, closed Kodiak Refuge to prospecting, development, extraction, and removal of locatable hardrock minerals (e.g., gold, silver, uranium, zinc). Section 304(c) of ANILCA reaffirmed this closure of the refuge. Panning for gold is permitted as a recreational activity throughout the refuge, in accordance with appropriate regulation.

Section 16 of the Federal Coal Leasing Amendment Act of 1975 (PL 94-377) prohibits coal mining on refuges.

Timber harvesting, aquaculture operations, large-scale hydroelectric developments, livestock grazing, oil and gas staging facilities, and leasing for minerals have been determined to be incompatible with refuge purposes due to potential adverse effects on the refuge populations of salmon, brown bear, eagles and other fish and wildlife. None of these activities is a traditional use of the refuge. They would not be be permitted under any alternative included in this plan.

15) Refuge Administration and Facilities

The Service's primary administrative facilities for Kodiak Refuge are located just outside the city of Kodiak, and on Coast Guard land which is covered under a cooperative agreement. The facilities consist of a headquarters/visitor center, shop/storage building, bunkhouse, and housing units for refuge staff. A triplex housing unit is also located in the city of Kodiak and a field camp is located on Camp Island, on Karluk Lake.

Several refuge facilities need to be added, replaced or rehabilitated to improve the Service's management capabilities and working/living conditions. At the Camp Island field camp the bunkhouse/shop facility should be replaced, and the living quarters/cooking facility should be examined to determine if structural rehabilitation or replacement is required. The triplex housing unit in the city of Kodiak needs to be rehabilitated. Three new storage facilities also are needed:

- one 4,000-square foot (370 m^2) unheated storage facility at the refuge headquarters
- four 200-square foot (18 m^2) storage sheds for the residences
- one 800-square foot (70 m^2) shop/storage facility at Camp Island

The refuge staff presently consists of ten persons: the refuge manager, an assistant manager, pilot/wildlife biologist, boat operator/wildlife biologist, pilot/fisheries biologist, outdoor recreation planner, maintenance worker, part-time laborer, and two clerk/typists. A wildlife biologist from the Alaska Office of Fish and Wildlife Research also is currently assigned to the refuge to conduct brown bear research. To effectively manage the refuge another permanent seasonal biologist technician is needed to monitor wildlife populations and assist in other projects during the summer field season. The need for increased law enforcement has also been identified by both the public and the refuge staff.

As called for in Section 1308(a) of ANILCA, the Service will whenever possible hire local residents who have lived or worked in Kodiak Refuge, or have special knowledge of the area, for positions on the refuge staff. Local residents considered for positions will not be subject to formal training provisions, employment preference provisions, or numerical limitations on personnel.

17) Refuge Management Plans

Following adoption of one of the alternatives as a comprehensive conservation plan, detailed refuge management plans will be prepared for Kodiak Refuge. These plans will describe the specific actions that will be taken to implement the general directions outlined in the comprehensive plan. They form the basis for annual work planning and annual budgeting.

Given the magnitude and urgency of the public use issues facing Kodiak Refuge, the Service will focus its efforts on completing a revised and updated refuge public use management plan as soon as possible. This management plan will provide specific, detailed guidance for managing public use, addressing such topics as commercial guiding and outfitting, cooperative management agreements with adjacent landowners, and site-specific problems such as litter and trespass. The plan will thus "step down" the broader management directions identified in the comprehensive conservation plan.

Other topics that may be addressed in the refuge management plans include: management of resident fish populations, brown bear, and other important fish and wildlife species; river management; water resource management; cultural resources management; wilderness management; and the environmental education and interpretive program.

The Service will work closely with other federal and state agencies and interested members of the public in preparing all of the Kodiak Refuge management plans. In particular, the fish and wildlife management plans will be coordinated with ADF&G. The Service will also prepare the cultural resource management plan in cooperation with the state.

DESCRIPTION OF THE ALTERNATIVES

Based on the purposes, resources, issues, and opportunities unique to Kodiak Refuge, four management alternatives have been formulated to guide management of the refuge. The alternatives are general in nature and provide broad strategies for management of refuge resources and uses. Each of the four alternatives designates areas within the refuge using the management categories described in the beginning of the chapter. Although the alternatives share common strategies, each alternative has a distinct overall emphasis. Table 21 at the end of this chapter summarizes the four alternatives and their major differences.

Each alternative includes a map showing the location and size of the management categories in the four alternatives. The maps are intended to only generally portray the alternatives and do not show all of the patented lands and Native allotments present within the refuge boundary.

Alternative A (Current Situation)

This alternative, the "no action" alternative, would maintain the existing range and intensity of management and recreational and economic uses. It is assumed that existing laws, executive orders, regulations and policies governing Service administration and operation of the National Wildlife Refuge System would remain in effect.

Alternative A would protect and maintain the refuge's fish and wildlife values and natural diversity. Disturbances to fish and wildlife habitats and populations would be minimized. Opportunities for hunting, fishing, and other recreational uses would be maintained, as would scientific research and wildlife observation opportunities. Existing temporary and permanent commercial fishing and guiding/outfitting support facilities would continue to be permitted along the refuge's coastline; no new permanent or temporary facilities would be permitted in the refuge's interior.

The following management directions summarize Alternative A. Alternative A would:

- maintain the refuge in an undeveloped state;
- emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats;
- maintain traditional access opportunities;
- provide for continued subsistence use of refuge resources;
- maintain opportunities for recreational hunting and fishing;
- permit guides and outfitters to operate in the refuge, with support facilities in designated areas;
- permit commercial fishermen to continue using support facilities on the refuge's coastline, with opportunities for limited expansion of temporary facilities; and
- propose no areas for wilderness designation.

Figure 36 shows the location of the management categories in Alternative A; Table 17 shows the distribution of refuge lands in each type of management category. Most of the refuge lands would be designated for minimal management and receive a high level of protection. All of the refuge's coastline, except for several of the heads of bays that provide key fish and wildlife habitat, would be managed as moderate management areas. The moderate management areas would extend from the mean high tide line back one-quarter of a mile (0.4 km). (See Table 15 for the fish and wildlife management activities, public uses and economic uses that would be permitted in these management categories.)

Figure 36 also shows the Service's protection levels for the Native lands subject to the provisions of Section 22(g). In this alternative (and all of the other alternatives) the Service would apply guidelines for resource protection on Native lands based on its assessment of the relative importance of the resources values present on these lands--the level of resource protection required under Section 22(g) would be tied closely to the resource values present. Areas that provide essential habitat, such as the Karluk River, Sturgeon River, and part of the Alitak Peninsula, still would be designated as Protection Level I lands and receive a high level of protection. Native lands in the interior of the refuge that provide important, but not essential, fish and wildlife habitat would be assigned to

Figure 36. Alternative A.

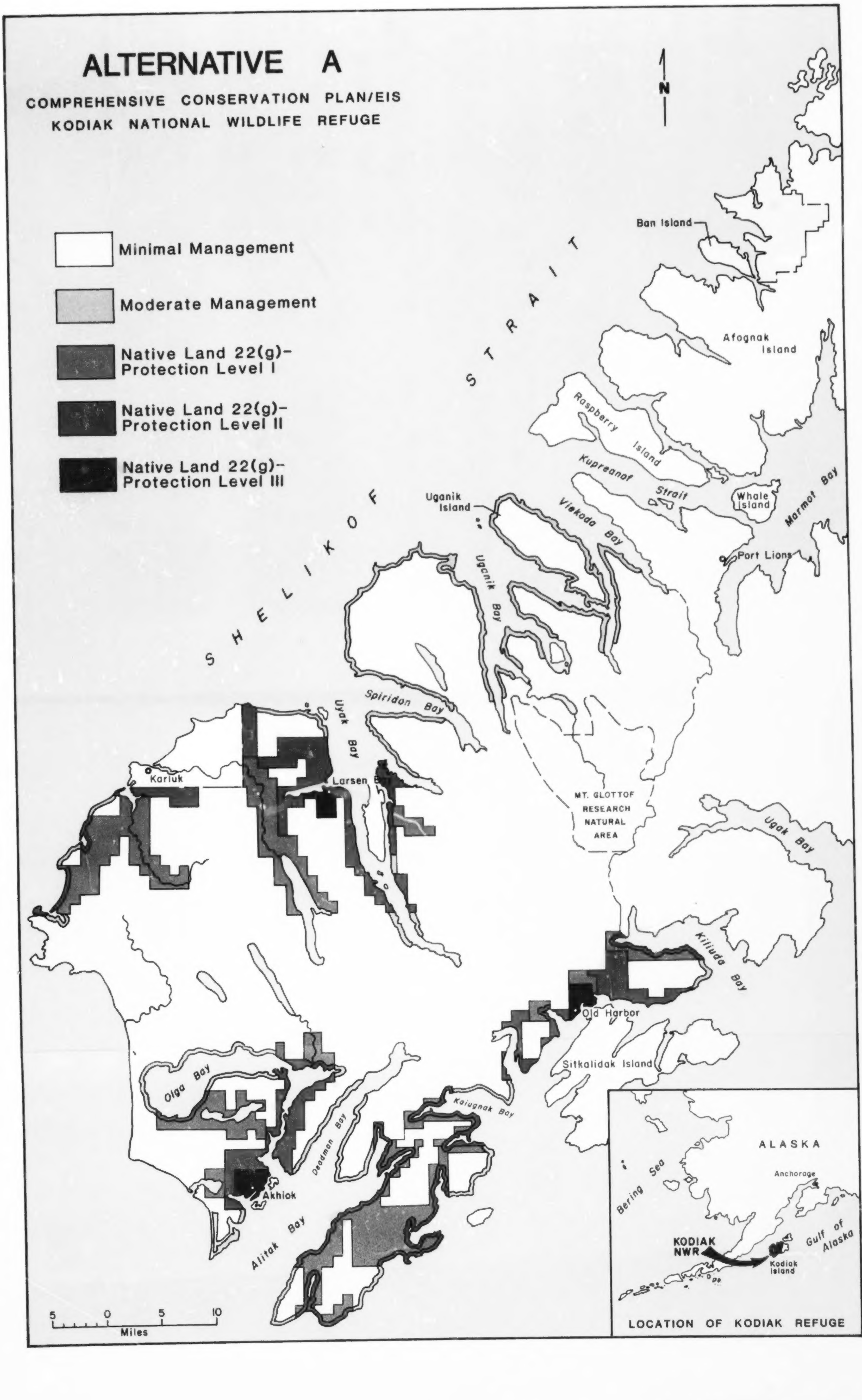

ALTERNATIVE A
COMPREHENSIVE CONSERVATION PLAN/EIS
KODIAK NATIONAL WILDLIFE REFUGE
N
Minimal Management
Moderate Management
Native Land 22(g)-Protection Level I
Native Land 22(g)-Protection Level II
Native Land 22(g)-Protection Level III
SHELIKOF STRAIT
Ban Island
Afognak Island
Raspberry Island
Kupreanof Strait
Whale Island
Marmot Bay
Port Lions
Uganik Island
Viekoda Bay
Uganik Bay
Spiridon Bay
Uyak Bay
Karluk
Larsen Bay
MT. GLOTTOF RESEARCH NATURAL AREA
Ugak Bay
Kiliuda Bay
Old Harbor
Sitkalidak Island
Olga Bay
Kaiugnak Bay
Deadman Bay
Akhiok
Alitak Bay
5 0 5 10
Miles
ALASKA
Anchorage
Bering Sea
Gulf of Alaska
KODIAK NWR
Kodiak Island
LOCATION OF KODIAK REFUGE

Figure 36. Alternative A

Table 17. Management category acreages in Alternative A.[a]

Unit	Acreage	Percentage of Refuge
Moderate management	107,000	7
Minimal management	1,379,000	93
Total	1,486,000	100
Native lands[b]	272,000	--
- Protection Level I lands	(148,000)	--
- Protection Level II lands	(109,000)	--
- Protection Level III lands	(15,000)	--

[a] Acreage figures throughout the plan are approximate due to rounding, uncertain boundaries, and inaccuracies in information available.

[b] These are lands that are subject to the provisions of Section 22(g). The Service has some residual controls over the use of these lands, but they are private lands, not part of the refuge.

Protection Level II. Protection Level III would generally include lands adjacent to the villages.

Fish and Wildlife Management

In Alternative A the Service would emphasize protection of existing fish and wildlife populations and habitats. Special attention would be given to protecting existing brown bear, eagle, tundra swan, and salmonid populations and habitats in the refuge. The Service and ADF&G would monitor these populations and work with the local villages and the public to ensure that the populations are maintained. Habitat enhancement generally would not occur. (Refer to the common management directions and Table 15 for additional fish and wildlife management directions.)

In this alternative the Service would conserve and protect aquatic habitats to support an allowable average annual commercial harvest of approximately 4,219,000 odd-year pink salmon, 8,291,000 even-year pink salmon, 534,000 chum, 866,000 sockeye, 84,000 coho and 2,000 chinook salmon from refuge based stocks. These harvests incorporate escapement goals of at least 800,000 odd-year pink, 3,746,000 even-year pink salmon, 369,000 chum, 1,088,000 sockeye, 55,000 coho and 16,000 chinook salmon. (The escapement goal for coho salmon is considered an index because actual escapement for coho is unknown.[a])

Salmon escapement and index goals would be directed to support an average annual sport fish harvest on the refuge of approximately 7,600 chinook and 7,620 coho. Habitat would also be maintained to support an estimated 5,300 to 15,000 steelhead. The Service intends to manage habitat to ensure that approximately 640 steelhead, 640 rainbow trout, and 1,600 char will be available for guided and unguided sport fishermen.

In this alternative fish weirs on the major systems will be maintained until late-September. Numerous Service management, administrative, research, and inventory activities that are presently underway, described in the fisheries common management direction, would continue.

Subsistence Management

Subsistence use in Alternative A would be managed as described in the common management directions and Table 15.

Public Use and Access Management

The public use common management direction and Table 15 generally describe how public use and access would be managed in Alternative A. Most visits to the refuge would be either for recreational and subsistence hunting and fishing, or for commercial fishing purposes during the salmon runs. All commercial operators working in the refuge, including air taxi operators and transporters, would be required to have special use permits.

All traditional forms of access would continue to be permitted in Alternative A. Floatplanes would be able to land on all water bodies throughout the refuge, while land planes could land on ocean beaches and on frozen waterbodies. Power boats (except for jet boats) would be allowed, subject to reasonable regulations, throughout the refuge; jet boats could be permitted in the moderate management areas. Snowmachines would be permitted during periods of adequate snow cover, except near brown bear denning areas. Other types of motor vehicles would not be permitted.

All of the refuge's public use cabins would continue to be maintained under Alternative A. New cabins, developed campsites, and trails also may be provided in the moderate management areas, depending on public use levels and potential conflicts with fish and wildlife resources.

No restrictions would be placed on the number of unguided users in the refuge. Time limits may be placed on a seasonal or area-specific basis with regards to how long groups using tents would be able to camp at one location. This action would be taken to ensure that other groups have the opportunity to use the same area or to minimize the potential for bear conflicts and other adverse impacts to fish and wildlife.

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[a] Escapement indices estimate the number of fish present in an area of a given size. Taken yearly, index figures measure the relative abundance of the species at a particular point in time.

Guiding and Outfitting

Fifteen big game guides and 11 sport fishing guides operated under permit on Kodiak Refuge in 1984. Five outfitters also took groups on the refuge. Under Alternative A licensed guides and outfitters would be permitted to operate throughout the refuge, subject to reasonable regulations (see the common management direction on guides and outfitters). The number of big game guides would continue to be regulated by the state.

The Service would permit the following number of other commercial guides and outfitters to operate on the refuge in Alternative A:

- A maximum of 24 sport fish guides would be permitted to operate on refuge freshwater streams and lakes, with no more than two guides permitted to have overnight camps on a given drainage.

- A maximum of 20 outfitters would be permitted to operate in the refuge.

More guides or outfitters may be permitted in the future if the Service determines that this use can occur without adversely affecting the resources.

In 1984, five guide cabins and one tent frame were permitted on refuge lands, and four guide cabins were permitted on Native lands. Guides with permanent support facilities under permit would continue to be permitted to use their facilities, subject to reasonable regulations; no new permanent facilities would be permitted in the refuge. Guides and outfitters may be permitted to use new temporary support facilities, such as tent frames and platforms, in the moderate management areas, subject to use stipulations. The temporary facilities could be used throughout the season of use. They would have to be dismantled after the season of use, but could be stored on-site.

Wilderness Proposal

In Alternative A no refuge lands would be proposed for wilderness designation.

Management Costs

In fiscal year (FY) 1985 Kodiak Refuge had a permanent staff of ten, and an operations and maintenance budget of $617,000; an additional $123,000 was allocated for fisheries related tasks. A 24% increase in funding and four staff would be needed to fully implement the common management directions (e.g., research, monitoring, education), and management directions in Alternative A. The additional staff and funding would be needed for law enforcement, to manage the expected increase in public use, and to monitor the impacts of public use on the refuge's fish and wildlife resources.

Alternative B

Under Alternative B the Service would continue to protect fish and wildlife populations and habitats, while providing opportunities for additional public use. Opportunities for hunting, fishing and other recreational uses would be increased by providing new public use cabins or developed campsites, increasing the number of permits for guides and outfitters that wish to operate on the refuge, and providing additional opportunities for guides and outfitters to use temporary facilities on designated areas in the refuge's interior and coast. Most of the refuge interior would be proposed for wilderness designation.

Alternative B shares the following management directions with Alternative A (the Current Situation). Alternative B would:

- maintain most of the refuge interior in an undeveloped state;
- emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats;
- maintain opportunities for sport hunting and fishing;
- maintain traditional access opportunities; and
- provide for continued subsistence use of refuge resources.

The following management directions indicate the major differences in Alternative B from Alternative A. Alternative B would:

- provide significantly more opportunities for guided and outfitted use on the refuge;
- provide additional opportunities for guides and outfitters to use temporary support facilities in designated parts of the refuge;
- provide additional opportunities for limited commercial development in designated areas in the interior and coast;
- provide additional cabins or campsites for the public to use; and
- propose most of the Kodiak Refuge interior for wilderness designation.

Figure 37 shows the distribution of the management categories in Alternative B; Table 18 indicates the sizes of the management categories. The two primary differences in this alternative from Alternative A are the proposed wilderness areas and the increase in size of the moderate management areas. All of the coastal areas, including the heads of bays, would be designated as moderate management areas. In addition, moderate management areas would be designated on Uganik Island, the Spiridon Peninsula, and in the vicinity of Larsen Bay, Kiluda Bay, and Three Saints Bay.

The Native lands subject to Section 22(g) would have the same protection levels assigned to them in Alternative B as in Alternative A.

Fish and Wildlife Management

The common management directions and Table 15 generally indicate how fish and wildlife would be managed. Under Alternative B the Service would continue to emphasize protection of fish and wildlife populations and habitats. Habitat enhancement generally would not occur.

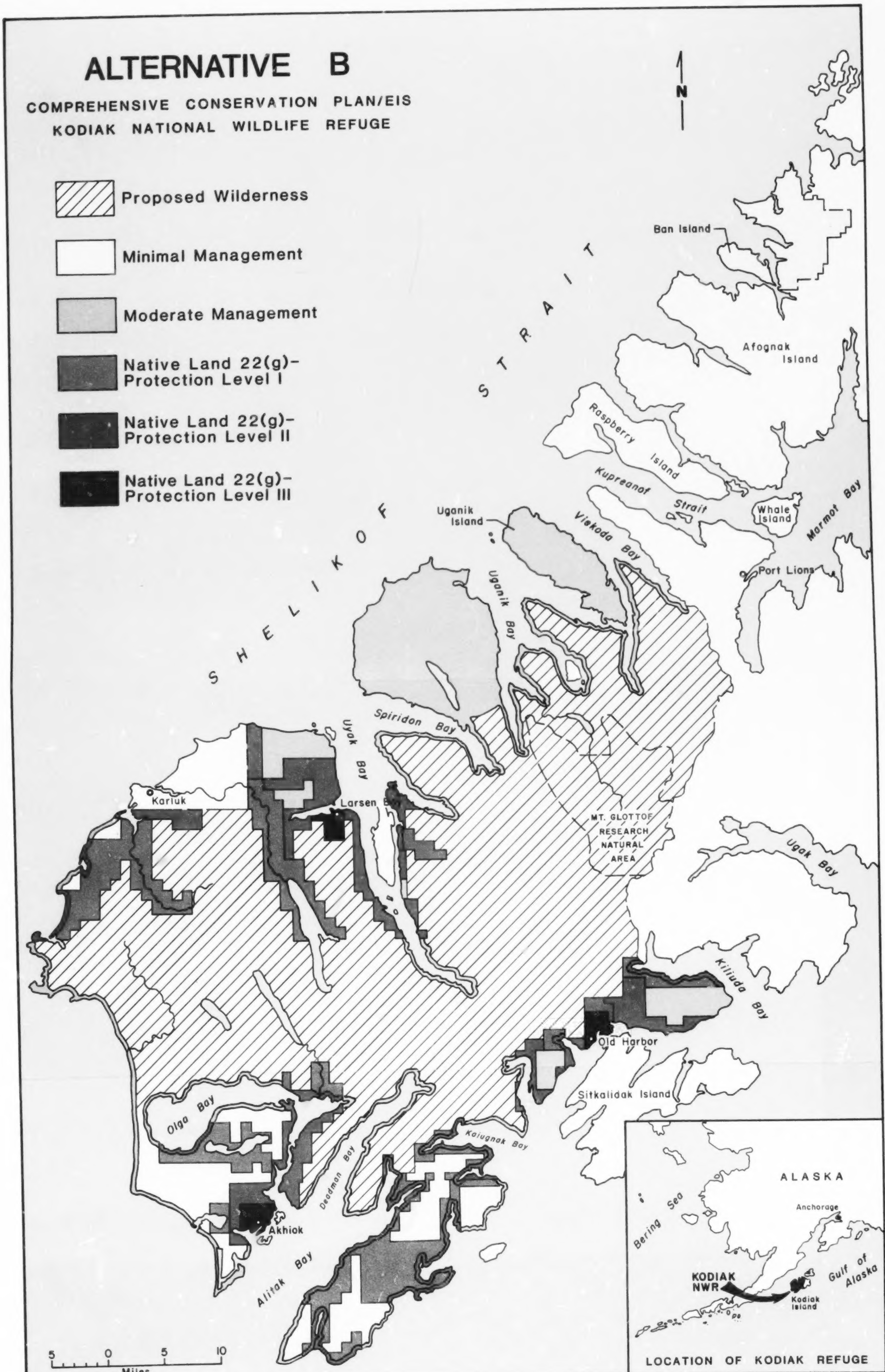
ALTERNATIVE B
COMPREHENSIVE CONSERVATION PLAN/EIS
KODIAK NATIONAL WILDLIFE REFUGE
Proposed Wilderness
Minimal Management
Moderate Management
Native Land 22(g)-Protection Level I
Native Land 22(g)-Protection Level II
Native Land 22(g)-Protection Level III
N
Ban Island
Afognak Island
Raspberry Island
Kupreanof Strait
Whale Island
Marmot Bay
Port Lions
Uganik Island
Viekoda Bay
Uganik Bay
SHELIKOF STRAIT
Spiridon Bay
Uyak Bay
Larsen Bay
Karluk
MT. GLOTTOF RESEARCH NATURAL AREA
Ugak Bay
Kiliuda Bay
Old Harbor
Sitkalidak Island
Olga Bay
Kaiugnak Bay
Deadman Bay
Akhiok
Alitak Bay
5 0 5 10
Miles
ALASKA
Anchorage
Bering Sea
Gulf of Alaska
KODIAK NWR
Kodiak Island
LOCATION OF KODIAK REFUGE

Figure 37. Alternative B

Figure 37. Alternative B.

Table 18. Management category acreages in Alternative B.[a]

Unit	Acreage	Percentage of refuge
Moderate management	271,000	18
Minimal management	153,000	10
Proposed wilderness[b]	1,058,000	72
Total	1,482,000	100
Native lands[c]	272,000	--
- Protection Level I lands	(148,000)	--
- Protection Level II lands	(109,000)	--
- Protection Level III lands	(15,000)	--

[a] Approximate acreage figures.

[b] All areas in the wilderness proposal will be managed as minimal management areas until the areas are designated by Congress.

[c] These are lands that are subject to the provisions of Section 22(g). The Service has some residual controls over the use of these lands, but they are private lands, not part of the refuge.

As in all of the alternatives the Service would focus special attention on protecting brown bear, eagle, tundra swan, and salmonid populations and habitats in the refuge. The Service and ADF&G would monitor these populations and work with the local villages, guides, and recreational hunters and fishermen to ensure that potential impacts to the populations and habitats are minimized. In addition to monitoring the effects of recreational use on fish and wildlife populations in this alternative, the Service would closely monitor other permitted activities to minimize impacts to fish and wildlife populations and their habitats.

In Alternative B the Service would set different fishery harvest and escapement goals from Alternative A, based on what contribution of refuge-based salmon stocks would be necessary to assist in meeting the 2002 goals outlined in the Kodiak Regional Comprehensive Salmon Plan (1984). The following harvest and escapement goals are projected estimates based on 1981 to 1984 data. The Service would conserve and protect aquatic habitats to support an allowable average annual commercial harvest of approximately 3,742,000 odd-year pink salmon, 9,761,000 even-year pink salmon, 568,000 chum, 826,000 sockeye 55,000 coho and 2,000 chinook salmon from refuge-based stocks. This harvest incorporates a escapement goal of at least 1,118,000 odd-year pink, 5,029,000 even-year pink, 428,000 chum, 1,291,000 sockeye, 54,000 coho and 9,000 chinook salmon.

Salmon escapement and index goals would be set to support an average annual sport fish harvest in the refuge of approximately 10,120 chinook and 10,140 coho. Habitat also would be maintained to support an estimated population of 5,300 to 15,000 steelhead. The Service would manage habitat to ensure that approximately 840 steelhead, 840 rainbow trout, and 2,100 char would be available for sport fishermen.

In this alternative the Service would assess all available spawning and rearing habitat for its production potential and refine wild stock harvest and escapement needs. Fish weirs would be operated beyond the current time periods to refine and monitor escapement needs and assist in setting commercial harvest levels. New weirs would be installed on several minor sockeye systems. Aerial surveys would be conducted intensively for a longer duration than now occurs to index escapement levels of those systems without fish weirs. Under this alternative actual numbers or index counts would be determined for coho salmon and steelhead trout that may enter selected systems throughout the fall months.

In addition to all of the tasks outlined in the common management directions, to achieve the above goals in Alternative B the Service would:

- increase sport fishery related law enforcement efforts on refuge waters;
- determine locations, extent of habitat use, and population characteristics of chinook salmon on the Karluk River;
- refine and identify escapement needs for chum and coho on the refuge;
- inventory habitats on those refuge streams that support coho salmon stocks and and streams that support minor sockeye salmon stocks;
- inventory habitats on those refuge streams that support chum salmon stocks with an adult escapement level estimated to be in excess of 10,000 fish; and
- conduct investigations to expand the data base on the locations, extent of habitat use, and population characteristics of wild rainbow trout stocks, Arctic char, and Dolly Varden char on the refuge.

Subsistence Management

Subsistence use in Alternative B generally would be managed as described in the common management directions and Table 15.

Public Use and Access Management

The Service would continue to permit all traditional forms of public access in this alternative (see the common management directions and Table 15). Floatplanes and power boats (except jet boats) would be allowed throughout the refuge, subject to regulations necessary to protect refuge resources. Land planes would be permitted to land on beaches and frozen waterbodies, while snowmachines would be permitted for traditional activities when the snow cover is adequate, except near brown bear denning areas. Jet boats could be permitted in the moderate management areas.

All of the refuge's public use cabins would continue to be maintained under Alternative B. New cabins, developed campsites, and trails also would be provided in the moderate management areas, either on Uganik Island, the Spiridon Peninsula, along the coastline, or in the other moderate management areas. The number of facilities and their location would depend on public use levels, and potential conflicts with fish and wildlife resources.

No restrictions would be placed on the number of unguided users in the refuge in this alternative. Time limits may be placed on a seasonal or area-specific basis with regards to how long groups with tents would be able to stay at one location. This action would be taken to ensure that other groups have the opportunity to use the same area or to minimize the potential for bear conflicts and other adverse impacts to fish and wildlife.

Guiding and Outfitting

In Alternative B the Service would continue to grant permits to all of the big game guides approved by the state guiding board, and would provide more permits for other licensed guides and outfitters to operate on the refuge than in Alternative A. The permits would include stipulations to minimize the potential for resource impacts (see the common management direction on guiding and outfitting).

The Service would provide substantially more opportunities for guided use and outfitted use (both consumptive and nonconsumptive) on the refuge in Alternative B than in 1984. The following number of commercial guides (in addition to big game guides) and outfitters would be permitted to operate on the refuge in Alternative B:

o A maximum of 36 sport fish guides, would be permitted to operate in the refuge, with no more than 3 guides permitted to have overnight camps on a given drainage.

o A maximum of 36 outfitters would be permitted to operate in the refuge.

More guides or outfitters may be permitted in the future if the Service determines that this use can occur without adversely affecting the resources.

In addition to providing opportunities for more groups in this alternative, guides and outfitters would be permitted to build and use temporary support facilities, such as tent frames, on Uganik Island, the Spiridon Peninsula, and the other moderate management areas on the coast and interior--temporary facilities could be used in 10% of the refuge in Alternative B. Guides and outfitters would be permitted to use the temporary facilities for the season of use. The facilities would have to be dismantled after the season of use, but could be stored on-site.

Wilderness Proposal

In Alternative B almost all of the refuge interior would be proposed for wilderness designation. All of these areas have qualities that are suitable for wilderness designation and would satisfy the Service criteria for its wilderness proposal. The Service would maintain the wilderness qualities of all the areas proposed for wilderness designation whether or not they are congressionally designated as wilderness.

The Red Peaks/Ban Island unit, Uganik Island and Spiridon Peninsula in the Zachar/Uganik unit, refuge lands south of Olga Bay, on the Aliulik Peninsula and between Three Saints Bay and Kiluda Bay in the Ayakulik/Uyak unit, and most of the refuge's coastline would not be included in the Service's wilderness proposal. The Red Peaks/Ban Island unit would not be proposed because the Service wants to retain its management options for this area--the Service may want to trade this area in the future for areas with more important fish and wildlife values. The moderate management areas on Uganik Island, the Spiridon Peninsula and in the refuge interior would not be proposed for wilderness designation because of the potential for additional development under this alternative. The refuge's coastline was not included primarily because of the large number of permitted commercial structures, Native allotments and patented lands. Similarly, refuge lands on the southwestern tip of the refuge, and on the Aliulik Peninsula were not proposed because of fragmented land ownership--village selections and inholdings and Native allotments would create potential management problems if this area was designated as wilderness.

Wilderness Management Actions - The Service would manage a designated wilderness area in accordance with the provisions of the Wilderness Act of 1964, ANILCA, and the guidelines of the Service's Refuge Manual (6 RM 8). Areas designated as wilderness would be managed to preserve their existing fish and wildlife populations and habitats, thus preserving their wilderness qualities. Traditional means of access, subsistence use, and other activities that took place before the passage of ANILCA would be permitted if they are compatible with refuge purposes as defined in ANILCA. Hunting, fishing, and trapping would continue to be permitted. Access by foot, aircraft, and boat into the wilderness area would be permitted. No new permanent structures would be permitted (except for administrative purposes) in a designated wilderness area. Motorized equipment would be permitted only if it is a minimum tool for administrative purposes.

Fish and wildlife - Fish and wildlife habitats in the wilderness area would be managed the same way as in the minimal management areas (see Table 15 and the fish and wildlife common management directions). Wildlife habitat restoration and manipulation could occur, if compatible with refuge purposes, although only the "minimum tools" necessary to achieve management objectives would be permitted.

Mechanical manipulation of wildlife habitat would not be permitted. Fishery management activities and use of temporary structures would be permitted in the area, provided they are compatible with refuge purposes and are the minimum tools to achieve management objectives. Construction of new permanent fishery management facilities, such as fish passes and hatcheries, would not be permitted. (Existing permanent facilities would not be affected by the wilderness designation.)

Commercial uses - Generally, commercial activities would be precluded from the area; however, traditional commercial recreational activities (i.e., guiding and outfitting) that do not require permanent facilities would continue to be permitted where compatible with refuge purposes.

The wilderness proposal would not affect the opportunity for logging on the Afognak Island Unit. However, commercial logging would not be permitted anywhere in the refuge, regardless of the wilderness designation (see the common management direction on other economic uses).

Hydroelectric facilities also would not be permitted anywhere in the refuge, regardless of the wilderness designation (see the common management direction on other economic uses).

Management Costs

Alternative B would require seven more staff and a 74% increase in funding over the current operations and maintenance budget to manage increased public use, to monitor commercial activities, particularly guiding, outfitters, and set netters, and to ensure that adverse impacts are minimized.

Alternative C (The Preferred Alternative)

Alternative C describes the way in which the Service proposes to manage Kodiak Refuge. Alternative C emphasizes protection of fish and wildlife populations and habitats, while providing for increases in public use. Special attention would be devoted to protecting the resource values in the Sturgeon, Karluk, Ayakulik/Red and Dog Salmon drainages. Opportunities for hunting, fishing and other recreational uses would be maintained. Additional opportunities would be provided for commercial guides and outfitters to use temporary support facilities and for other commercial uses along the coast. Most of the refuge interior would be proposed for wilderness.

Alternative C shares the following management directions in common with Alternative A (the Current Situation). Alternative C would:

- maintain the refuge in an undeveloped state;
- emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats;
- maintain traditional access opportunities;
- maintain opportunities for sport hunting and fishing;
- provide for continued subsistence use of refuge resources; and
- permit commercial fishermen, guides and outfitters to use support facilities on the refuge's coastline, with opportunities for limited expansion of temporary facilities.

The following management directions indicate the major differences in Alternative C from Alternative A. Alternative C would:

- provide additional opportunities for guided and outfitted use in the refuge;
- provide increased protection of fish and wildlife resources on coastal areas;
- manage use on the Ayakulik/Red, Sturgeon, Karluk and Dog Salmon drainages to protect sensitive fish and wildlife resources and provide a primitive recreational experience; and
- propose most of the areas suitable for wilderness in the refuge interior for wilderness designation.

Figure 38 shows the distribution of the management categories in Alternative C; Table 19 shows the size of the management categories. Moderate management areas, accounting for 6% of the refuge, would be designated on the northern and southern coastline. Unlike the previous alternatives all of the refuge lands on the west coast, from Halibut Bay to Cape Alitak, would be proposed for wilderness management in this alternative. Coastal areas that are extremely important to waterfowl, raptors, shorebirds, seabirds, and other fish and wildlife, including the heads of Deadman, Uyak, Zachar, Spiridon, and Terror bays, and the east arm of Uganik Bay also would be included either as minimal management areas or proposed for wilderness. Uganik Island, Spiridon Peninsula, and refuge lands surrounded by conveyed and selected lands north of Larsen Bay, south of Olga Bay, on the Aliulik Peninsula, and between Three Saints Bay and Kiluda Bay, accounting for a total of 21% of refuge lands, would be designated as minimal management areas but would not be proposed for wilderness. Special river management areas would be designated along the four drainages in the southwest part of the refuge to protect and maintain the

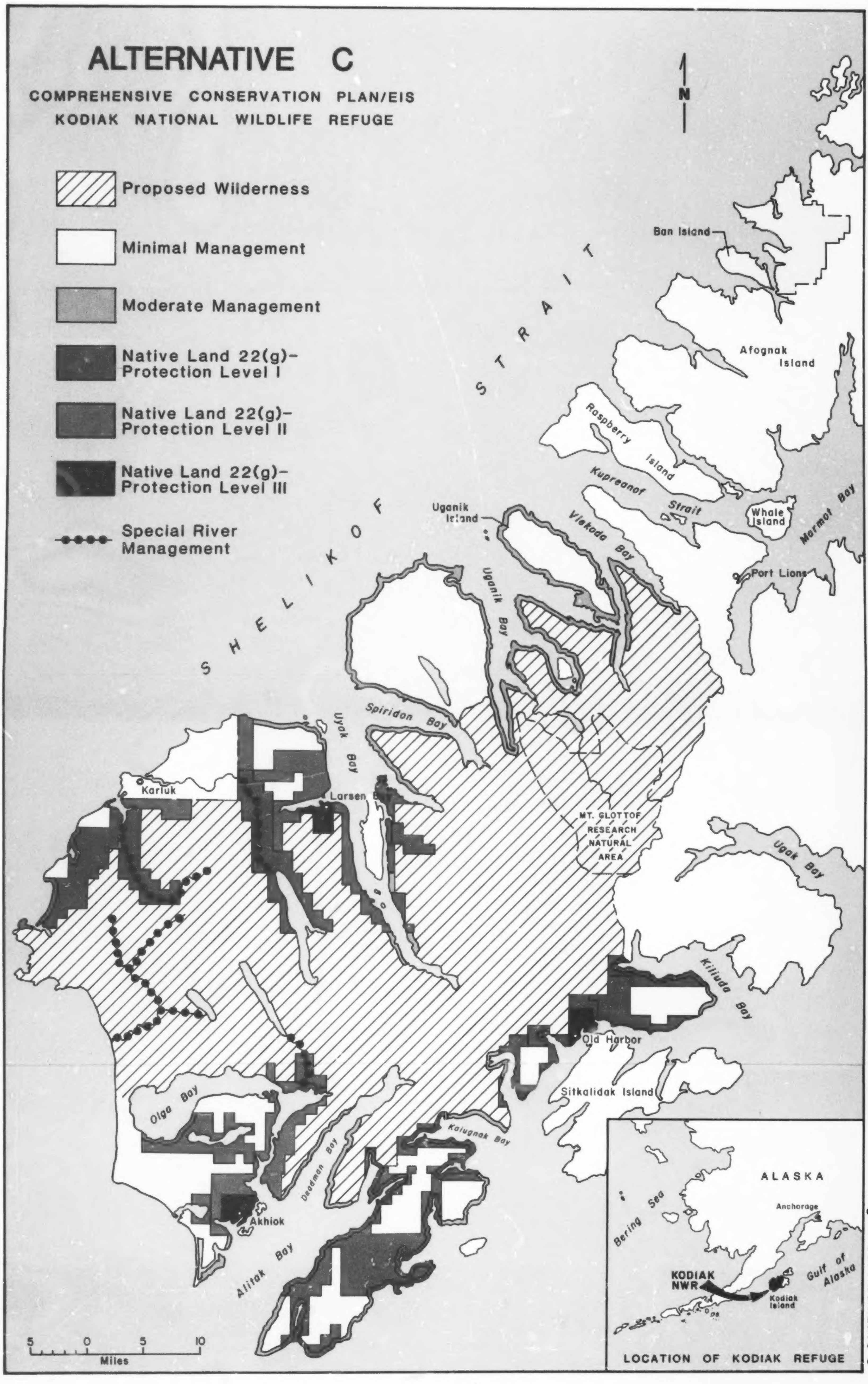
ALTERNATIVE C
COMPREHENSIVE CONSERVATION PLAN/EIS
KODIAK NATIONAL WILDLIFE REFUGE
▨ Proposed Wilderness
☐ Minimal Management
Moderate Management
Native Land 22(g)-Protection Level I
Native Land 22(g)-Protection Level II
Native Land 22(g)-Protection Level III
Special River Management
N
Ban Island
Afognak Island
Raspberry Island
Kupreanof Strait
Whale Island
Marmot Bay
Port Lions
Uganik Island
Viekoda Bay
Uganik Bay
SHELIKOF STRAIT
Spiridon Bay
Uyak Bay
Karluk
Larsen Bay
MT. GLOTTOF RESEARCH NATURAL AREA
Ugak Bay
Kiliuda Bay
Old Harbor
Sitkalidak Island
Olga Bay
Kaiugnak Bay
Deadman Bay
Akhiok
Alitak Bay
5 0 5 10
Miles
ALASKA
Anchorage
Bering Sea
KODIAK NWR
Kodiak Island
Gulf of Alaska
LOCATION OF KODIAK REFUGE

Figure 38. Alternative C

Figure 38. Alternative C.

Table 19. Management category acreages in Alternative C.[a]

Unit	Acreage	Percentage of refuge
Moderate management	87,000	6
Minimal management	310,000	21
Proposed wilderness[b]	1,074,000	73
Total	1,471,000	100
Native lands[c]	272,000	--
- Protection Level I lands	(148,000)	--
- Protection Level II lands	(109,000)	--
- Protection Level III lands	(15,000)	--

[a] The size of the special river management category is not included in this table as it extends beyond the refuge boundary, and includes substantial amounts of Native selected and conveyed lands; refuge riparian areas adjacent to the Karluk, Sturgeon, Dog Salmon, and Ayakulik/Red rivers would be included in this category. Consequently, the total acreage for refuge lands in this table varies from Tables 17 and 18. All acreage figures are approximate.

[b] All areas in the wilderness proposal will be managed as minimal management areas until the areas are designated by Congress.

[c] These are lands that are subject to the provisions of Section 22(g). The Service has some residual controls over the use of these lands, but they are private lands, not part of the refuge.

physical, biological and recreational qualities of the rivers and adjacent refuge lands, including water quality and quantity. (See Table 15 for the types of fish and wildife management activities, public uses and economic uses that would be permitted in each type of management category.)

The Native lands subject to Section 22(g) would have the same protection levels assigned to them in Alternative C as they would in Alternative A.

Fish and Wildlife Management

The common management directions and Table 15 describe how the Service would manage fish and wildlife in Alternative C. The Service would emphasize protection of existing fish and wildlife populations and habitats. Habitat enhancement generally would not occur. Special attention would be devoted to managing the brown bear, eagle, tundra swan and salmonid populations and habitats. The Service and ADF&G would monitor these populations and work with the local villages, guides, and refuge users to ensure that the populations are maintained.

The Service would follow the same management goal for conserving and protecting aquatic habitats, based on average annual commercial harvests, in Alternative C as in Alternative B--harvest and escapement goals would be based on what contribution of refuge based salmon stocks is necessary to assist in achieving the goals outlined in the Kodiak Regional Comprehensive Salmon Plan. For sport fishing salmon escapement and index goals would be established to support an average annual harvest in the refuge of approximately 8,400 chinook and 8,400 coho. Habitat would also be maintained to support an estimated 5,300 to 15,000 steelhead. The Service would manage habitat to ensure that approximately 700 steelhead, 700 rainbow trout, and 1,750 char would be available for guided and unguided sport fishermen.

In Alternative C the Service would assess all available spawning and rearing habitat for its production potential and refine wild stock harvest and escapement needs. Fish weirs would be operated beyond the current time period to refine and monitor escapement needs and assist in setting commercial harvest levels. New weirs would be installed on several minor sockeye systems. Aerial surveys would be conducted intensively for a longer duration than now occurs to index escapement levels of those systems without fish weirs. Actual numbers or index counts would be determined for coho salmon and steelhead trout that enter selected systems throughout the fall months.

In addition to the tasks noted in the common management directions, to achieve its fishery goals in Alternative C the Service would:

- determine location, extent of habitat use, and population characteristics of chinook salmon on the Karluk River;
- refine and identify escapement needs for chum and coho on the refuge;
- inventory habitats on those refuge streams that support coho salmon stocks and streams that support minor sockeye salmon stocks;
- inventory habitats on those refuge streams that support chum salmon stocks with an adult escapement level estimated to be in excess of 10,000 fish;
- conduct investigations to expand the data base on the locations, extent of habitat use, and population characteristics of wild rainbow trout stocks, Arctic char and Dolly Varden char on the refuge; and
- conduct sport fishing related law enforcement efforts.

Subsistence Management

Subsistence use in Alternative C generally would be managed as described in the common management directions and Table 15.

Public Use and Access Management

Public use and access generally would be managed as described in the common management directions and Table 15. All traditional forms of access would continue to be permitted throughout most of the refuge. Floatplanes and power boats (except jet boats) would be allowed throughout most of the refuge, subject to regulations necessary to protect refuge resources. Land planes would be permitted to land on beaches and frozen waterbodies. Snowmachines would be permitted on the refuge when the snow cover is adequate, except near brown bear denning areas. Jet boats could be permitted in the moderate management areas.

On the Sturgeon, Ayakulik/Red, Karluk and Dog Salmon special river management areas the Service would work with the adjacent land owners to protect resource values and provide for public access. The Service would seek cooperative agreements to ensure that the rivers' resource values are maintained.

The Service may limit access or limit the number of visitors in the special river management areas to protect resource values. Use has been increasing rapidly on these rivers. On the Ayakulik/Red River the use of boat motors and float planes may be restricted if necessary to protect fish and wildlife values and to maintain a primitive recreational experience. The length of time visitors could stay at any one site also may be of shorter duration than the rest of the refuge. If use continues to increase it may become necessary to institute a permit system and regulate the number of visitors on the river at any given time. Use would only be restricted if:

- o human use of these areas caused significant disturbance to bears during feeding periods;
- o human use caused significant disturbance to nesting, resting or feeding bald eagles;
- o the sport fishing harvest threatened any fish population; or
- o significant conflicts between user groups required temporal or spatial separation to prevent concentrations of users and to maintain primitive recreational opportunities.

No access restrictions would take effect until the procedural requirements of Section 1110(a) of ANILCA and 50 CFR 36.42 have been satisfied. If this alternative is adopted, the Service would be required to give notice of the intended action, develop regulations, and hold a hearing in the vicinity of the river before taking any actions.

All of the refuge's public use cabins would continue to be maintained under Alternative C. New cabins, primitive campsites, and trails may be provided in the moderate management areas on the coast, depending on public use levels and potential conflicts with fish and wildlife resources.

Except as noted in the special river management areas, the Service would take no actions to limit the number of unguided users on the refuge. As in all of the alternatives, the Service may place time limits on a seasonal or area-specific basis with regards to how long groups with tents would be able to stay at one location. This action would be taken to ensure that other groups have the opportunity to use the same area or to minimize the potential for bear conflicts and other adverse impacts to fish and wildlife.

Guiding and Outfitting

In Alternative C licensed guides and outfitters would be able to operate throughout the refuge, under special use permit. The permits issued to the operators would include stipulations to minimize the potential for resource impacts (see the common management direction on guiding and outfitting). The Service would continue to grant permits to all of the big game guides approved by the Alaska guide Licensing and Control Board. The Service would provide more opportunities for guided use and outfitted use (both consumptive and nonconsumptive) in this alternative than in 1984.

The Service would permit the following number of commercial guides (besides big game guides) and outfitters to operate on the refuge in Alternative C:

- A maximum of 24 sport fish guides would be permitted to operate on the refuge, with no more than 2 guides permitted to have overnight camps on a given drainage.

- A maximum of 18 outfitters would be permitted to operate in the refuge.

The Service would closely monitor the effects of all these groups on the refuge. Additional guides or outfitters could be permitted in the future if the Service determines that this use could be sustained without adversely affecting the refuge's resources or other users.

Guides and outfitters would be permitted to use temporary support facilities in the moderate management areas on the coast, accounting for 6% of the refuge. New temporary support facilities, such as tent platforms and frames, may be permitted in these moderate management areas, subject to use stipulations. These facilities could be used throughout the season of use. They would have to be dismantled after the season of use, but could be stored on-site. No new support facilities would be permitted in the interior of the refuge.

Wilderness Proposal

The Service would propose the same areas for wilderness designation in Alternative C as in Alternative B: most of the refuge (about 72%) would be proposed for wilderness designation. Most of the Ayakulik/Uyak wilderness review unit and the Zachar/Uganik unit would be included in the proposal. These areas all have outstanding wilderness values and would be unique additions to the National Wilderness Preservation System (see the wilderness review in the Affected Environment). They all would satisfy the Service's criteria for wilderness designation. The Service would maintain the wilderness qualities of all the areas proposed for wilderness designation whether or not they are congressionally designated as wilderness.

The Red Peaks/Ban Island unit, Uganik Island/Spiridon Peninsula unit, refuge lands south of Olga Bay, on the Aliulik Peninsula and between Three Saints Bay and Kiluda Bay in the Ayakulik/Uyak unit, and most of the refuge's coastline (except for the west end) would not be included in the Service's wilderness proposal. These areas were not proposed in the preferred alternative primarily because the Service wants to keep open its management options for these areas. The Red Peaks/Ban Island unit was not included in the proposal because the Service may want to trade this area in the future for areas with more important fish and wildlife values. Uganik Island and the Spiridon Peninsula were not included in the proposal because the Service wants to retain its options for managing these areas, such as providing for public use in the future. The refuge's coastline was not included primarily because of the large number of permitted commercial structures, Native allotments and patented lands. Similarly, the southwestern tip of the refuge was not proposed because of fragmented land ownership--village selections and inholdings and Native allotments would create potential management problems if this area was designated as wilderness.

Wilderness Management Actions - The Service would manage a designated wilderness area as described in Alternative B. Traditional means of access, subsistence use, recreational hunting, fishing and trapping, and other activities that took place before the passage of ANILCA would be permitted if they are compatible with refuge purposes as defined in ANILCA. No new permanent structures would be permitted (except for administrative purposes). Motorized equipment would be permitted only if it is a minimum tool for administrative purposes.

Fish and wildlife - Fish and wildlife habitats in the wilderness area would be managed the same way as in the minimal management areas (see Table 15 and the fish and wildlife common management directions). Wildlife habitat restoration and manipulation could occur, if compatible with refuge purposes, although only the "minimum tools" necessary to achieve management objectives would be permitted. Mechanical manipulation of wildlife habitat would not be permitted. Fishery management activities and use of temporary structures would be permitted in the area, provided they are compatible with refuge purposes and are the minimum tools to achieve management objectives. Construction of new permanent fishery management facilities, such as fish passes and hatcheries, would not be permitted. (Existing permanent facilities would not be affected by the wilderness designation.)

Commercial uses - Most commercial activities and facilities, including logging and new hydroelectric facilities, would be precluded; however, traditional commercial recreational activities (i.e., guiding and outfitting) that do not require permanent facilities would continue to be permitted where compatible with refuge purposes.

Management Costs

Alternative C would require about five more staff and a 44% increase in funding over the current operations and maintenance budget. The increases would be needed to manage the expected increase in public use and to better analyze both the refuge fishery resources and impacts of increasing public use on the fishery resources.

Alternative D

Of all the alternatives considered, Alternative D would provide the maximum protection to fish and wildlife values. The Service would restore important habitat on the coastline by removing existing commercial support structures whenever legally possible, such as when operations cease or are abandoned. Opportunities for hunting, fishing and other recreational uses would continue to be provided in the refuge, although the growth in guided, outfitted, and general public use and access may be limited in parts of the refuge to minimize potential resource impacts. Commercial uses would be limited to existing valid commercial fishing support facilities and guiding and outfitting. Existing permanent and temporary commercial support structures would continue to be allowed, but the Service would work with the users to remove structures where there are resource concerns. New commercial operators would be based out of tents that would be removed after the season of use--no new permanent or temporary support facilities would be permitted in the refuge. All of the refuge lands would be proposed for wilderness designation.

Alternative D has the following similarities with Alternative A (the Current Situation). Alternative D would:

- maintain the refuge in an undeveloped state;
- emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats;
- maintain traditional access opportunities;
- provide for continued subsistence use of refuge resources;
- permit guides and outfitters to operate in the refuge, with limited support facilities in designated areas; and
- permit commercial fishermen to continue using support facilities on the refuge's coastline, with opportunities for limited expansion of temporary facilities.

The following management directions indicate the major differences in Alternative D from Alternative A. Alternative D would:

- restore fish and wildlife habitat along coastal areas by removing commercial support facilities wherever possible;
- manage use on the Ayakulik/Red, Sturgeon, Karluk and Dog Salmon drainages to protect sensitive fish and wildlife resources and to provide a primitive recreational experience;
- reduce the number of public use cabins in the refuge;
- reduce levels of guided sport fishing, and outfitted use in the refuge;
- require guides and outfitters to use tents;
- regulate the number of unguided users in the refuge if necessary; and
- propose all of the refuge lands for wilderness designation.

In Alternative D refuge lands would be designated as minimal management areas and proposed for wilderness designation, or designated as special river management areas. Figure 39 shows the distribution of the management categories in Alternative D; Table 20 shows the size of the management categories. Virtually all of the refuge lands would be designated as minimal management areas and proposed for wilderness designation. Special river management areas would be designated for the Ayakulik/Red, Dog Salmon,

Figure 39. Alternative D

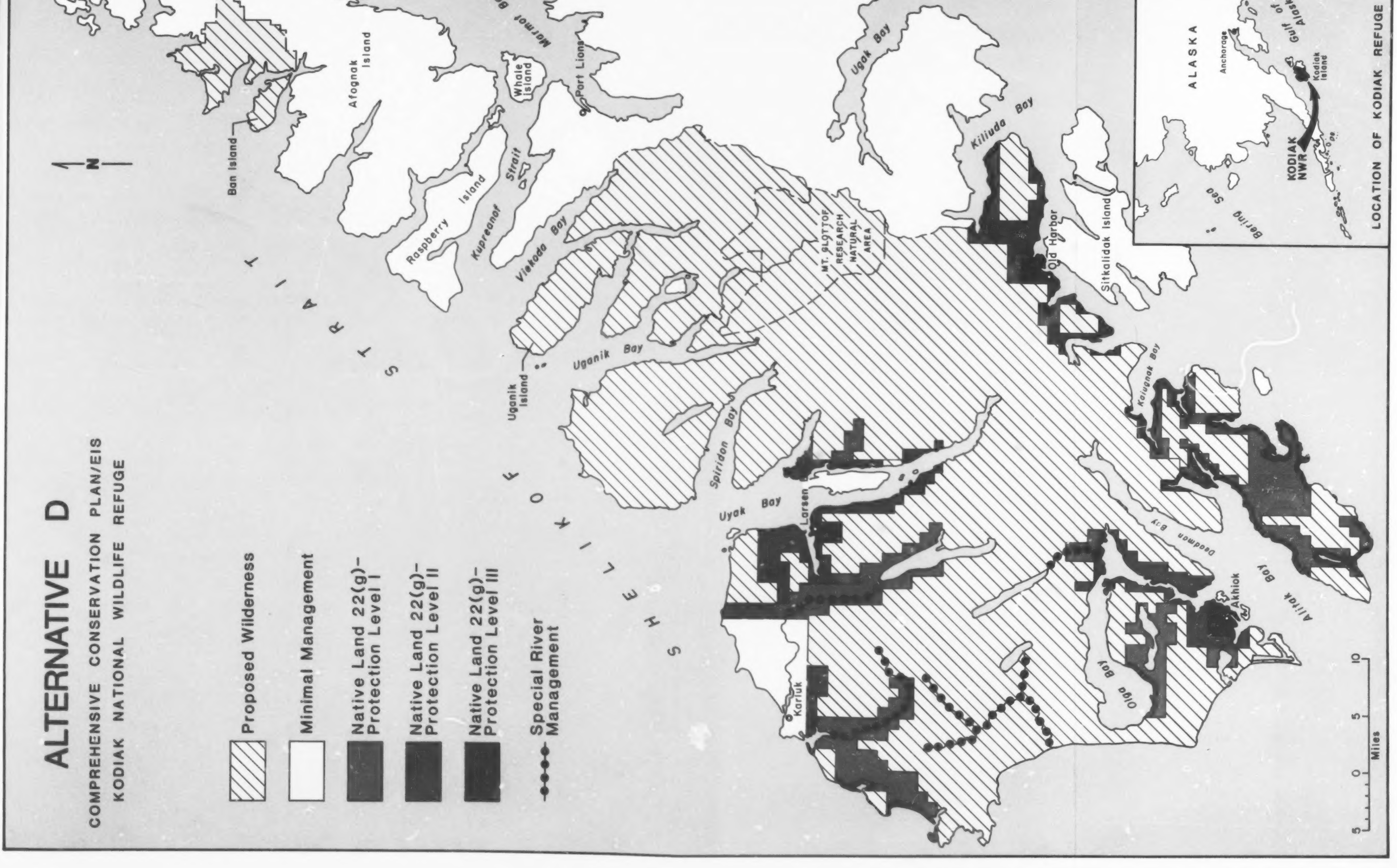
ALTERNATIVE D
COMPREHENSIVE CONSERVATION PLAN/EIS
KODIAK NATIONAL WILDLIFE REFUGE
Proposed Wilderness
Minimal Management
Native Land 22(g)-Protection Level I
Native Land 22(g)-Protection Level II
Native Land 22(g)-Protection Level III
Special River Management
N
Ban Island
Afognak Island
Marmot Bay
Whale Island
Port Lions
Raspberry Island
Kupreanof Strait
Viekoda Bay
Uganik Bay
Uganik Island
Spiridon Bay
Uyak Bay
Larsen
Karluk
SHELIKOF STRAIT
MT. GLOTTOF RESEARCH NATURAL AREA
Ugak Bay
Kiliuda Bay
Old Harbor
Sitkalidak Island
Kaiugnak Bay
Deadman Bay
Alitak Bay
Akhiok
Olga Bay
0
5
10
Miles
ALASKA
Anchorage
Gulf of Alaska
Kodiak Island
Bering Sea
KODIAK NWR
LOCATION OF KODIAK REFUGE

Figure 39. Alternative D.

Table 20. Management category acreages in Alternative D.[a]

Unit	Acreage	Percentage of refuge
Proposed wilderness[b]	1,469,000	100
Total	1,469,000	100
Native lands[c]	272,000	--
- Protection Level I lands	(148,000)	--
- Protection Level II lands	(109,000)	--
- Protection Level III lands	(15,000)	--

[a] The size of the special river management category is not included in this table as it extends beyond the refuge boundary, and includes substantial amounts of Native selected and conveyed lands; refuge riparian areas adjacent to the Karluk, Sturgeon, Dog Salmon, and Ayakulik/Red rivers would be included in this category. Consequently, the total acreage for refuge lands in this table varies from the total acreages in Tables 17 and 18. All acreage figures in the table are approximate.

[b] All areas in the wilderness proposal will be managed as minimal management areas until the areas are designated by Congress.

[c] These are lands that are subject to the provisions of Section 22(g). The Service has some residual controls over the use of these lands, but they are private lands, not part of the refuge.

Karluk and Sturgeon drainages. (See Table 15 for the types of fish and wildlife management activities, public uses and economic uses that would be allowed in each type of management category.)

The Native lands subject to Section 22(g) would have the same protection levels assigned to them in Alternative D as they would in Alternative A.

Fish and Wildlife Management

In Alternative D the Service would continue to protect fish and wildlife populations and habitats as described in the common management directions and Table 15. Habitat enhancement generally would not occur. Special attention would be given to managing brown bear, eagle, tundra swan and salmonid populations and habitats in the refuge. The Service and ADF&G would monitor these populations and work with the local villages, guides, and refuge users to ensure that the populations are maintained at least at their present levels.

The Service would follow the same management goal for conserving and protecting aquatic habitats, based on average annual commercial harvests, in Alternative D as in Alternative B--harvest and escapement goals would be based on what contribution of refuge based salmon stocks is necessary to assist in achieving the goals outlined in the Kodiak Regional Comprehensive Salmon Plan. For sport fishing salmon escapement and index goals would be established to support an average annual harvest in the refuge of approximately 6,480 chinook and 6,480 coho. Habitat would also be maintained to support an estimated 5,300 to 15,000 steelhead. The Service would manage habitat to ensure that 540 steelhead, 540 rainbow trout, and 1,350 char would be available for guided and unguided sport fishermen.

In Alternative D the Service would assess all available spawning and rearing habitat for its production potential and refine wild stock harvest and escapement needs. Fish weirs would be operated beyond the current time period to refine and monitor escapement needs and assist in setting commercial harvest levels. New weirs would be installed on several minor sockeye systems. Aerial surveys would be conducted intensively for a longer duration to index escapement levels of those systems without fish weirs. Actual numbers or index counts would be determined for coho salmon and steelhead trout that enter selected systems throughout the fall months.

In addition to the tasks outlined in the common management directions, in Alternative D the Service would:

- determine the location, extent of habitat use, and population characteristics of chinook salmon on the Karluk River;
- refine and identify escapement needs for chum and coho on the refuge;
- inventory habitats on those refuge streams that support coho salmon stocks and streams that support minor sockeye salmon stocks;
- inventory habitats on those refuge streams that support chum salmon stocks with an adult escapement level estimated to be in excess of 10,000 fish;
- conduct investigations to expand the data base on the locations, extent of habitat use, and population characteristics of wild rainbow trout stocks, Arctic char and Dolly Varden char on the refuge; and
- conduct sport fishing related law enforcement efforts.

Subsistence Management

Subsistence use in Alternative D generally would be managed as described in the common management directions and Table 15.

Public Use and Access Management

The public use common management directions and Table 15 generally indicate how the Service would manage recreation and access in Alternative D. All traditional forms of access would continue to be permitted. Floatplanes and power boats (except for jet boats) would be permitted, with reasonable regulations. Land planes would be permitted on frozen waterbodies and beaches. Snowmachines would be permitted on the refuge when snow depths are adequate, except near brown bear denning areas.

In the Sturgeon, Ayakulik/Red, Karluk and Dog Salmon special river management areas the Service would work with the adjacent land owners to protect resource values and provide for public access. The Service would seek cooperative agreements to ensure that the rivers' resource values are maintained.

The Service may restrict public uses and access in the special river management areas if necessary to protect the resource values of these rivers or minimize potential conflicts between different user groups. Hunting, fishing, trapping, and other recreational uses all may be limited in specific areas or times. The length of time visitors could stay at any one site also may be more limited than the rest of the refuge. All access methods, including hiking, also may be regulated if necessary to minimize disturbance to refuge resources. No access restrictions would take effect until the procedural requirements of Section 1110(a) of ANILCA and 50 CFR 36.42 have been satisfied. If this alternative is adopted, the Service would be required to give notice of the intended action, develop regulations, and hold a hearing in the vicinity of the area before taking any actions.

In Alternative D no new public use facilities would be provided in the refuge. Existing public use cabins in the southwestern part of the refuge would be dismantled to disperse use and to reduce the potential for conflicts with bears and other impacts to fish and wildlife.

In Alternative D the Service would begin to actively manage the growth of unguided use in the refuge. The purpose of this action would be to reduce the potential for bear/human conflicts and impacts to other refuge resources, and to maintain the present high quality recreation opportunities and wilderness character of Kodiak Refuge. Specific actions that would be taken to regulate unguided use would be addressed in the public use management plan. In addition to removing some of the public use cabins, the Service may begin to limit the number of unguided users on the refuge. This could be done either by regulating the number of transporters that take people onto the refuge, or limiting where they can take clients, or by instituting a permit system. The Service may place time limits on a seasonal or area-specific basis, such as in the special river management areas, regarding how long groups with tents would be able to stay at one location. This action would be taken to ensure that other groups have the opportunity to use the same area or to minimize the potential for bear conflicts and other adverse impacts to fish and wildlife.

Guiding and Outfitting

In Alternative D the Service would continue to permit big game guides approved by the Alaska Guide Licensing and Control Board. The increase in other commercial guides and outfitters, however, would be limited to reduce the potential of bear/human conflicts, overcrowding on popular rivers, and conflicts with other user groups. The Service would provide fewer permits for these commercial operators than in Alternative A (although more than in 1984). The permits issued to all of the guides and outfitters would include stipulations to minimize the potential for resource impacts (see the common management direction on guiding and outfitting).

The Service would permit the following number of commercial guides (besides big game guides) and outfitters to operate on the refuge in Alternative D:

- A maximum of 12 sport fish guides would be permitted to operate on the refuge, with one guide permitted to have overnight camps on a given drainage.

- A maximum of 10 outfitters would be permitted to operate in the refuge.

The Service would closely monitor the impacts of these groups on the refuge. Additional guides or outfitters could be permitted in the future if the Service determines that this use could be sustained without adversely affecting the refuge's resources or other users.

In addition to limiting the number of guides and outfitters, in this alternative the Service would require all of the commercial operators to use tents--permanent and temporary structures would not be permitted. Guided and outfitted groups may be limited on how long they can stay at one location in the refuge, depending on the season and area, to ensure that other groups have the opportunity to use the same area or to minimize the potential for bear conflicts and other adverse impacts to fish and wildlife.

Wilderness Proposal

Under Alternative D the Service would propose all of the federal lands within the refuge boundary for wilderness designation. The Service would maintain the wilderness qualities of all the areas proposed for wilderness designation whether or not they are congressionally designated as wilderness.

Wilderness Management Actions - The Service would manage a designated wilderness area as described in Alternative B. Traditional means of access, subsistence use, recreational hunting, fishing, and trapping, and other activities that took place before the passage of ANILCA would be permitted if they are compatible with refuge purposes as defined in ANILCA. No new permanent structures would be permitted (except for administrative purposes) in a designated wilderness area. Motorized equipment would be permitted only if it is a minimum tool for administrative purposes.

Fish and wildlife - Fish and wildlife habitats in the wilderness area would be managed the same way as in the minimal management areas (see Table 15 and the fish and wildlife common management directions). Wildlife habitat restoration and manipulation could occur, if compatible with refuge purposes, although only the "minimum tools" necessary to achieve management objectives would be permitted. Mechanical manipulation of wildlife habitat would not be permitted. Fishery management activities and use of temporary structures would be permitted in the area, provided they are compatible with refuge purposes and are the minimum tools to achieve management objectives. Construction of new permanent fishery management facilities, such as permanent fish passes and hatcheries, would not be permitted. (Existing permanent facilities would not be affected by the wilderness designation.)

Commercial uses - Most commercial activities and facilities, including logging and new hydroelectric facilities, would be precluded from the area; however, traditional commercial recreational activities (i.e., guiding and outfitting) that do not require permanent facilities would continue to be permitted where compatible with refuge purposes.

Management Costs

Alternative D would require an increase of four staff and a 35% increase in funding over the current operations and maintenance budget. The increases would be needed to manage and monitor public use and to better analyze refuge fishery resources.

Table 21. Summary of the four alternatives for Kodiak Refuge.

Table 21. Summary of the alternatives for Kodiak Refuge.

Management	Alternative A (Current Situation)	Alternative B	Alternative C	Alternative D
Fish & Wildlife	High level of protection provided to populations and habitats	Fish and wildlife populations and habitats protected	High level of protection provided to populations and habitats	High level of protection provided to populations and habitats
Access	Existing access opportunities maintained	Existing access opportunities maintained	Access opportunities may be limited in the special river management areas	Access opportunities may be limited in the special river management areas
Subsistence	Continued opportunities for harvests assured	Continued opportunities for harvests assured	Continued opportunities for harvests assured	Continued opportunities for harvests assured
Public Use Facilities	All public use cabins maintained	Additional cabins and campsites provided	Additional cabins and campsites may be provided	Public use cabins may be removed
Guided and Outfitted Use	Increased numbers of sport fish guides and outfitters permitted; all big game guides permitted	Additional opportunities provided for sport fish guides and outfitters; all big game guides permitted	Some increases in sport fish guides and outfitters permitted; all big game guides permitted	Sport fish guides maintained at about existing levels; limited increases in outfitters; all big game guides permitted
New Commercial Support Facilities	New temporary structures may be permitted all along the coastline; no new permanent facilities permitted	New temporary structures may be permitted along the coastline and on Uganik Island, Spiridon Peninsula, and other moderate management areas; no new permanent facilities permitted	New temporary structures may be permitted along the coastline except for the heads of bays with high wildlife values; no new permanent facilities permitted	No new temporary or permanent support facilities permitted
Wilderness Proposal	No areas proposed for designation	Most of the refuge lands proposed for wilderness designation except for Uganik Island, Spiridon Peninsula, Red Peaks/Ban Island, and other areas surrounded by Native conveyed/selected lands	Most of the refuge lands proposed for wilderness designation except for Uganik Island, Spiridon Peninsula, Red Peaks/Ban Island, and other areas surrounded by Native conveyed/selected lands	All of the refuge lands proposed for wilderness designation
Management Costs	About a 20% increase in costs over the present	About a 71% increase in cost over the present	About a 48% increase in cost over the present	About a 42% increase in cost over the present

VII. ENVIRONMENTAL CONSEQUENCES

VII. ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The purpose of this chapter is to identify, describe, analyze, and compare the significant biological and socioeconomic impacts that would result from implementing each of the management alternatives, especially those related to scoping issues. Each alternative contains many broad management directions. To provide a basis for assessing the alternatives, descriptions of likely activities and use levels were prepared. These scenarios focus on public (recreational) and commercial use of the refuge.

A public use scenario was developed for each alternative. The scenarios are based on the management directions for that alternative and on the Service's best estimates of recreational use. It must be stressed that the use estimates are based on limited available data, and are not intended to indicate precisely the level of recreational use in 1984 or 1995. It is also important for the reader to understand that the number of visitors on the refuge does not necessarily reflect the intensity of use--one deer hunter, for example, may stay on the refuge for 7 days and have a different effect than a sport fisherman who visits the refuge for a day of fishing.

In all of the scenarios development of Native lands could occur, but it is assumed that the Service's protection level objectives that apply to those lands would minimize impacts. No significant expansion of commercial fishing onshore facilities would be permitted in any of the alternatives, although some increases in facilities may be permitted: 54 commercial set net fishing cabins and 10 tent frames would continue operating within the refuge boundary in all of the scenarios, of which 32 cabins and 2 tent frames would be on Native lands. Two canneries also would continue to receive permits. Finally, 5 guide cabins and 1 guide tent frame on refuge lands and 4 guide cabins on Native lands would continue to be permitted in all of the scenarios.

Native allotments adjacent to the refuge also could be developed, as could patented sites on the coastline, with the potential for significant impacts on the refuge's fish and wildlife populations and habitats. The use of these lands are not specifically assessed here, because it is not possible to predict the location or amount of development--the Service does not have the authority to dictate what may or may not occur on these lands. If use originating on Native allotments and patented sites adversely affects refuge resources or public use opportunities, levels of commercial activities (i.e., guiding and outfitting) permitted on the refuge may have to be reduced below the levels described in each of the following scenarios. The cumulative effects of the facilities on Native allotments and patented sites are generally addressed in the Alternative A assessment summary, and are assumed to be the same in the other three alternatives.

It is assumed in all of the scenarios that the regulatory process administered by the Alaska Boards of Fish and Game would avoid excessive harvests. Should a resource allocation become necessary between competing user groups, local subsistence users would receive priority over recreational hunters, as prescribed by federal law.

READEX FICHE

The reader should understand that neither the Service's selection of a preferred alternative nor the adoption of a plan necessarily means that all of the specific use levels outlined in the scenarios, including timing and locations, would happen exactly as described. The scenarios are sets of reasonable assumptions and estimates that provide a basis for assessing each alternative.

Definitions

Because of the general nature of the assessment and the lack of numerical and statistical information regarding refuge resources, impacts are often expressed in relative terms. The meanings of these terms are as follows:

Fish and Wildlife Resource Impacts

- Major impact - affecting a regional or local population of a species sufficiently to cause a decline in abundance or a change in distribution beyond which natural recruitment would not likely return that population to its former level within several generations.

- Moderate impact - affecting a portion of a regional or local population sufficiently to cause a change in abundance or distribution over more than one generation, but unlikely to affect the integrity of the regional population as a whole.

- Minor impact - affecting a specific group of individuals of a population in a localized area for one generation or less; the integrity of the regional population is not likely affected.

- Negligible impact - the degree of anticipated biological impact is considered less than minor.

- Short-term impact - for wildlife species a change that persists less than five years from onset of the disturbance; for fish species a change that persists less than one year.

- Long-term impact - for wildlife species a change that persists five or more years from onset of the disturbance; for fish species a change that persists more than one year.

Water Quality Impacts

- Major impact - extensive changes in the physical, chemical or biological parameters of a waterbody, on the level of several orders of magnitude, to a degree that renders the waterbody unacceptable for use by humans or fish and wildlife species, creates a health hazard, or otherwise impairs the beneficial uses of the waterbody.

- Moderate impact - a statistically significant change in the physical, chemical or biological parameters of a waterbody that cannot be overcome without man-induced corrective measures.

- Minor impact - a change in some or all of the normal measures of water quality, such as oxygen content, temperature, transmittance, trace metal concentrations, and hydrocarbon levels, but the change is either not statistically different from ambient conditions, or the change deviates significantly but can be readily overcome by the waterbody's natural withstanding capacity.

- Short-term impact - a change that persists for one year or less.

- Long-term impact - a change that persists for more than one year.

General Public Use Assumptions

Several assumptions hold for all of the scenarios that were developed for the management alternatives:

- Present trends of socioeconomic and demographic variables (e.g., population growth rates of the state, the cost of air taxis, the state of the economy) and environmental variables (e.g., weather) that affect public use on the refuge will continue into the future (to 1995).

- Subsistence use is assumed not to significantly increase--changes in state or federal laws or regulations will not markedly change the subsistence harvest.

- The state's sport hunting and fishing and guiding regulations will remain the same as those in force in 1985 - e.g., 15 big game guides will continue to be granted exclusive bear guiding rights on the refuge.

- Kodiak Refuge's reputation for deer hunting, sport fishing and other recreational uses will attract more Alaska residents and nonresidents as the island and refuge become more widely known in the next ten years.

- The relative proportion of sport fishing in each drainage will remain the same as it is presently exists: about 15% of sport fishing on the refuge will occur on the Red/Ayakulik system, 20% on the Uganik system, 25% on the Karluk drainage, 10% on the Frazer/Dog Salmon system, and 30% on the other drainages and lakes.

- The number of bear hunters will remain relatively unchanged through 1995.

- The number of clients each guide or outfitter takes on the refuge, particularly guided sport fishing and deer hunting clients, will double in all of the alternative scenarios over the next ten years: each sport fish guide will take an average of 100 clients on the refuge in 1995 and each outfitter will take an average of 80 clients.

- The revenues guides and outfitters charge each client and the number of days each client is on the refuge will remain constant in all of the alternative scenarios from 1984 to 1995: outfitters will charge an average of $250/client/day with each client staying 5 days; big game guides will charge an average of $500/client/day for deer hunting, with each client staying 6 days on the refuge; and sport fish guides will charge an average of $500/day with two-thirds of the clients being day users and the other users staying an average of 4 days.

- All cabins and tent frames on the refuge will be used at their present capacity; all tent frames will be occupied throughout the permitted season of use.

- The refuge's unguided use level will double by 1995, with all types of unguided use (e.g., big game hunting, sport fishing) increasing at about the same rate; 30% of the use would be deer hunters, 35% would be sport fishermen, and 35% would be other users (bear and other hunters, backpackers, photographers, etc.).

- All groups in the interior of the refuge, except guided and resident bear hunters, would stay at one location for a maximum of 7 days; bear hunter groups would stay up to 15 days at one site.

- The majority of recreational use on the refuge will continue to be hunting and fishing; nonconsumptive uses such as photography and backpacking will remain a small but expanding proportion of the total use.

ALTERNATIVE A

Scenario

In the Alternative A scenario the Service would continue to manage the refuge as it has in the past. Opportunities for hunting, fishing and other recreational uses would be maintained. Overall public use levels would more than double by 1995. No additional facilities for recreational purposes would be provided. Nine public use cabins would be maintained on refuge lands, while two cabins are assumed to be maintained by Natives on Native lands. Fifty-four permanent commercial fishing facilities and ten temporary facilities would continue to operate on the refuge coastline over the next ten years.

In the Alternative A scenario the Service would take only limited actions that would affect the increases in guided use on the refuge and no actions that would significantly affect unguided use. A total of 35 temporary use facilities would be permitted for guides and outfitters along the refuge's coastline. Commercial operators using these temporary use facilities, primarily deer hunters, could stay for the season of use. The Service would permit 2 sport fish guides on each drainage for overnight use and each guide to operate on 2 drainages. The 18 sport fish guides using the refuge would not be restricted for day use operations.

Table 22 shows the projected use levels for each of the major recreational use groups in Alternative A and the other alternatives; Table 23 projects fish harvest levels for the alternatives. Use levels in 1995 are estimated as follows:

- Total public use would increase from 7,400 visitors in 1984 to 16,700 visitors in 1995, primarily due to the increase in unguided use--the number of unguided users, primarily deer hunters and sport fishermen, would double from 6,550 to 13,100 people. The number of guided and outfitted visitors (22% of total use) would triple in this scenario, increasing from 850 people in 1984 to 3,600 people in 1995.

- Fifteen big game guides would take 200 clients into the refuge, of which about 100 clients would be bear hunters and 100 clients would be deer hunters.

- Twenty outfitters and recreation guides would operate on the refuge, a four-fold increase from 1984. Together with an increase in the number of clients each outfitter takes on the refuge, the number of outfitted visitors would increase from an estimated 200 visitors in 1984 to 1,600 visitors (primarily deer hunters) in 1995.

- The number of sport fish guides would increase from 11 guides in 1984 to 18 guides in 1995, a 50% increase. This number includes both day use guides and overnight use guides; no more than two sport fish guides would have overnight use privileges on any single drainage. The number of clients each sport fish guide takes out on the refuge also would double. Thus, the total number of guided sport fish visitors would more than triple in ten years, going from about 550 to 1,800 visitors.

Biological Effects of Alternative A

Fish

Alternative A would include key and important overwintering, spawning and rearing aquatic habitats for anadromous and resident fish species under minimal management. It is anticipated there would be no impact to the aquatic habitat from current management and research activities in the refuge under this alternative.

In Alternative A (and all of the other alternatives) a possible management activity that could result in adverse impacts is the artificial fertilization of Karluk Lake, a sockeye rearing lake. Investigations at Karluk Lake are underway to assess the feasibility of introducing chemical nutrients into the lake to enhance zooplankton production, and thus increase an available food source for juvenile sockeye rearing in the lake. The three spined stickleback, *Gasterosteus acleatus*, has been identified as a possible major competitor with juvenile sockeye for the same zooplankton food source. Recent research efforts at Karluk Lake have indicated that the stickleback targets on a smaller size range of zooplankton than juvenile sockeye rearing in the lake. The addition of artificial nutrients to the lake may increase available zooplankton levels for stickleback, in addition to sockeye, and compound the competition factor once fertilization efforts cease. This could have a major

Table 22. Estimated use levels on Kodiak Refuge for the four alternative scenarios.

USE TYPE	1984 USE LEVEL^{a}	PROJECTED 1995 USE LEVELS Alternative A Scenario	Alternative B Scenario	Alternative C Scenario	Alternative D Scenario
Big Game Guiding					
- Guides	15	15	15	15	15
- Clients	100	200	200	200	200
Sport Fish Guiding					
- Guides	11	18	36	24	12
- Clients	550^{b}	1,800^{c}	3,600^{c}	2,400^{c}	1,200^{c}
Outfitted Groups					
- Outfitters	5	20	36	18	10
- Clients^{d}	200^{e}	1,600^{f}	2,900^{f}	1,400^{f}	800^{f}
Total Guided and Outfitted Use	850	3,600	6,700	4,000	2,200
Unguided Use^{g}	6,550	13,100^{h}	13,800^{i}	13,100^{h}	12,000^{j}
TOTAL USE	7,400	16,700	20,500	17,100	14,200

[a] All use levels are rounded and are based on 1984 use data on file at Kodiak Refuge and the best estimates of the refuge staff.

[b] In 1984 it is estimated that each sport fish guide had an average of 50 clients.

[c] It is estimated in 1995 that the number of clients per sport fish guide would increase from 50 to 100 clients per guide.

[d] Outfitted clients are primarily deer hunters.

[e] It is estimated in 1984 that each outfitter had an average of 40 clients.

[f] In 1995 it is estimated that the number of clients per outfitter would increase from 40 to 80 clients.

[g] Unguided use includes sport fishermen, deer hunters, and resident bear hunters.

[h] This level assumes 9 public use cabins.

[i] With an increase of 9 new public use cabins and campsites, and assuming 80 people per facility, 700 unguided visitors would be added to the 13,100 in this scenario.

[j] The decrease in unguided visitors from 13,100 to 12,000 visitors would be due to a decrease in the number of public use cabins from 9 to 5 (reducing the number of unguided visitors by 300), a decrease of 500 deer hunters, and decreasing the number of sport fishermen on the Ayakulik River by 300.

Table 23. Projected 1995 sport fish harvest levels for the four alternative scenarios.

Species	% of Use b/	Alternative A		Alternative B		Alternative C		Alternative D	
		Total Use Visit/ Species	Estimated Harvest	Total Use Visit/ Species	Estimated Harvest	Total Use Visit/ Species	Estimated Harvest	Total Use Visit/ Species	Estimated Harvest
Chinook	60	3,830	7,600	5,060	10,120	4,200	8,400	3,240	6,480
Coho	20	1,270	7,620	1,690	10,140	1,400	8,400	1,080	6,480
Steelhead	10	640	640	840	840	700	700	540	540
Rainbow	5	320	640	420	840	350	700	270	540
char	5	320	1,600	420	2,100	350	1,750	270	1,350

a/ Harvest levels are projected for both guided and unguided fishermen. It is assumed that 35% of unguided use in each alternative is for sport fishing. Harvest rates were calculated assuming: 2 chinook/visit, 6 coho/visit, 1 steelhead/visit, 2 rainbow/visit, and 5 char/visit. Hooking mortality is unknown and will probably inflate figures especially for steelhead caught incidental during spring spawning periods.

b/ The % use column represents the percent of total visits that are spent fishing for the indicated species.

impact on the survival of juvenile sockeye while in fresh water, leading to reduced smolt size and possibly decreasing marine survival and total recruitment.

Under the Alternative A scenario it is projected that commercial harvest and escapement levels for refuge-based salmon stocks would continue to support the overall goals for natural stocks set in the Kodiak Regional Comprehensive Salmon Plan-2002 (Kodiak Regional Planning Team, 1984). With the exception of even-year pinks, the 1981 to 1984 refuge-wide total returns for all salmon species are within approximately 10% of the 2002 goals in the regional salmon plan. Given favorable conditions in both the freshwater and marine environments, the natural refuge-based pink, chum, sockeye and chinook stocks should remain at or near 1981 to 1984 levels. Commercial fishing is expected in this scenario to have negligible impacts on the age structure and recruitment potential for pink, chum, sockeye and chinook salmon.

The effect of commercial fishing on coho salmon in this scenario is less clear. Coho escapement is indexed through aerial surveys and partial weir counts that are usually terminated in the early fall months. Furthermore, not all streams are indexed annually. Commercial harvest figures for refuge-based

From 1981 to 1984 the average annual value of refuge sockeye harvested by Kodiak fishermen was estimated at $3.9 million.

coho indicate a mean 1981 to 1984 harvest of 84,000 coho with a mean index of 55,000 fish. Data trends compiled by ADF&G since 1979 indicate coho harvests are much higher than in previous years, which may be due to extremely strong coho returns. Without sufficient data to estimate accurate escapements, baseline commercial harvest rates of 40 to 50 percent may be exceeded, impacting broodstock escapement. Thus, the commercial harvest of coho in this scenario may result in a moderate long-term impact on refuge-based coho stocks.

Sport harvests of refuge-based salmon stocks are expected to increase under Alternative A. A sport fish harvest of 7,620 coho from refuge stocks is projected under this scenario. It is not known what this harvest rate is in relation to total returns of coho because of the lack of accurate harvest and escapement data noted above. Assuming commercial fish harvest management takes into account the sport harvest, the projected 1994 sport fish harvest to an unknown total population would have a minor long-term impact on refuge coho stocks.

The 1981 to 1984 average total returns of chinook in the refuge is estimated at 18,000 fish and is projected to remain at this level under the Alternative A scenario. With an average total escapement to spawning streams of 16,000 chinook projected to occur between 1985 and 1995, commercial fishermen would harvest 2,000 fish outside of the refuge. Approximately 57 and 42 percent of the total escapement is destined for the Karluk and Ayakulik rivers, respectively. For the purpose of this analysis, these systems are combined and considered as one. Sport fish harvest estimates for chinook on the refuge from unguided and guided visits are projected to result in a combined harvest of about 7,600 chinook. The in-river harvest and commercial offshore harvest combined is estimated at 9,600 fish, resulting in an exploitation rate of approximately 53%. There are no data available on the upper limits of exploitation possible for natural northern chinook stocks, but most wild stocks of salmon cannot indefinitely sustain a exploitation rate in excess of 60%. Estimates of a maximum harvest rate for natural chinook populations suggest that 50% may be near the upper limit. Based on these assumptions, the sport and commercial fishery combined in Alternative A would have a minor impact on chinook stocks on the refuge. This conclusion is also based on the assumption that the commercial offshore harvest would remain at the previous 1981 to 1984 average of 2,000 chinook (11% of the total return). If commercial interception is increased and the sport fishery remains as projected under this alternative, a major long-term impact could occur to the refuge chinook stocks.

The effects of a sport fish harvest of 640 steelhead projected for this alternative is unknown. Although a total estimated population range of 5,300 to 15,000 steelhead is suspected on the refuge, absolute population numbers are unknown. The complex life history characteristics of steelhead, such as the fact that repeat spawners may constitute between 16 and 43% of the total run, makes it difficult to assess potential impacts. There is also an unknown hook and release mortality due to improper fish handling by anglers. It is anticipated that if steelhead harvest levels are increased from less than 200 in 1984 to 640 fish in 1995 a major long-term impact could occur to refuge steelhead stocks.

As with steelhead, no baseline data are available to analyze the effects of the projected rainbow trout sport harvest. It is suspected that most rainbow populations on the refuge are extremely small, localized stocks that could not withstand any sustained harvest for more than one generation. Increasing the sport harvest to about 640 rainbow trout in this scenario consequently may cause a moderate long-term impact to the refuge's rainbow trout populations.

The harvest of 1,600 char from refuge populations is expected to have a negligible impact on the overall population. Although the total population level is unknown, char appear to be relatively abundant throughout the refuge and can probably sustain a higher harvest level than that projected in the Alternative A scenario.

Waterfowl

About 90 to 95 percent of the refuge's waterfowl habitat would be protected in minimal management areas under Alternative A. The projected increases in sport fishing levels along the Red/Ayakulik River would cause negligible disturbance of tundra swans and other nesting waterfowl because most nesting occurs upstream from major access points in this system. Inner bay and tidal flats areas would not be subjected to disturbance from the projected increase in overall public use. Generally, management under this alternative would result in negligible impacts to refuge waterfowl populations.

Shorebirds

A majority of the shorebird nesting habitat on the southwest portion and inner bay areas of the refuge would be protected under minimal management in Alternative A. With the projected increases in public use more people would visit inner bays for late fishing and early deer hunting trips. Although migratory shorebird staging occurs in limited areas on the refuge, some disruption of staging and feeding in the inner bay areas would occur as public use increases. Overall, however, effects of this alternative on refuge nesting and migrating shorebird populations would be negligible.

Raptors

Nesting and feeding habitats for bald eagles and other raptors are distributed along the entire Kodiak coastline. Inner bay and tidal flat areas are generally used more than other coastal habitats for foraging and nesting by raptors. Disturbance due to increased human use and facility construction along the coastline under moderate management could result in localized impacts to some nesting and feeding raptors. These impacts would be short-term and negligible.

Marine Birds

A majority of the refuge's marine birds nest on offshore islands and islets along the coastline. Moderate management of the coastline would allow more human use and disturbance from added temporary facility construction along the coast. Results of increased power boat and airplane traffic near nesting colonies could result in greater egg and chick losses through sudden disturbance of adults from nest sites. Reductions in marine bird populations, however, is anticipated to be negligible under this alternative.

Marine Mammals

While several species of marine mammals inhabit the entire Kodiak archipelago (e.g. harbor seals, sea lions, sea otters), few species actually use refuge lands or waters. (An exception is the large numbers of sea otters using Parmanof and Foul bays in the Afognak Island unit of the refuge.) Although the proposed actions in Alternative A would not directly affect areas below the mean high tide, increased human use of shorelines and waters could result in increased disturbance and harassment of marine mammals. Consequently, minor impacts to marine mammals using near shore areas are expected in this scenario.

Deer

Both deer populations and hunter harvests have increased on the refuge in recent years. Due to the inaccessibility of much of the refuge, no long-term impacts are expected as a result of increased hunting pressure. With the number of unguided deer hunters doubling, however, some negligible or minor short-term impacts could occur in localized areas where hunting activity is concentrated. Areas where these impacts would be expected include Uganik Island, Viekoda Bay, Terror Bay, and the Spiridon Peninsula.

Deer hunting could have a positive benefit for deer habitat in localized areas. If the deer population were ever to increase to the point it could overbrowse an area, deer hunting would relieve overbrowsing by excessive deer.

Brown Bear

In the Alternative A scenario commercial shore-based fishing and big game guiding activities would remain at current levels. Consequently, these uses are expected to continue to have a negligible impact on brown bears.

Minor and short-term impacts would most likely occur from the projected increases in public use on western portions of the refuge, from Uyak Bay north to Viekoda Bay. Increased levels of deer hunting probably would cause a proportional increase in bears killed in defense of life and property (DLPs). Brown bears in most popular deer hunting areas would become increasingly habituated to human activity and become conditioned to visiting common camp sites and areas where deer are most frequently taken. A substantial increase in human/bear encounters is predicted, resulting in increased DLP kills of females accompanied by cubs or yearlings. This could have short-term moderate impacts on brown bear recruitment to local populations. Increased sport fishing on portions of the Spiridon Peninsula and in the vicinity of Uganik Lake also could cause minor adverse short-term effects.

Increases in DLP mortality would be expected in the southwest portions of the refuge. A small increase in DLP mortality may occur due to increased deer hunting, but impacts should be negligible because of the relatively small numbers of deer hunters using this area. Current regulations controlling guided sport fishing also should result in negligible impacts to bear.

Unguided sport fishing, and to a lesser degree nonconsumptive users such as photographers, has the highest potential to affect bears in the southwestern portions of the refuge. A substantial increase in the levels of these users has the potential to concentrate people in areas that are important feeding habitat for bear. The increased probability for human/bear encounters may cause an increase in DLP kills, but the most important effect would be the displacement of bears from key habitats. Displacement of bears has the potential for minor impacts in certain areas around Red, Frazer, and Karluk lakes, on Dog Salmon Creek and Sturgeon River, and at the heads of Uyak and Deadman bays.

Overall, habitat conditions and population levels of brown bear currently are stable and should remain so under Alternative A. Impacts are expected to vary somewhat on a geographical basis from increased recreational use: most impacts would be negligible except in coastal areas north of Uyak Bay where localized minor to moderate short-term impacts are expected due to increased deer hunting effort.

Water Quality/Quantity

Most of the impacts to water quality would result from the projected increase in sport fishing on the major river systems in the southwestern portion of the refuge. With more people using these rivers the potential exists for increased levels of pollution from improper disposal of wastes, streambank erosion and shoreline degradation. Impacts are expected to be localized around popular campsites and access points and would probably remain at the minor level. Intensified public environmental awareness programs are expected to lessen the negative effects of increased public use. Water quantity would not be affected by any actions permitted in this alternative.

Socioeconomic Effects of Alternative A

Population

The Alternative A scenario would have a negligible effect on the population of the city of Kodiak and other village communities. In the scenario public use is projected to double by 1995. During the fishing and hunting seasons there would be a large influx of visitors coming into the city of Kodiak. This increase would affect the seasonal population of the city, but the effect on the permanent population would be negligible.

Economy

The primary economic effects of the Alternative A scenario would be due to the increase in public use of the refuge. In the scenario the amount of guided, outfitted and unguided use would all increase between 1984 and 1995. With an expected increase in use, the number of jobs for guides, outfitters and their staff would increase. In addition, the operators would take in more revenues from more clients:

- Sport fish guides would realize an estimated \$1.8 million from 1,800 clients in 1995, an increase of about \$1 million from 1984.[a]

- Outfitters would collect an estimated \$2.25 million from 1,600 clients in 1995, an increase of \$2 million from 1984.

- Big game guides would receive an estimated \$300,000 from 100 guided deer hunter clients which they presently do not collect.

Thus, under this scenario commercial guides and outfitters would receive an estimated \$4.35 million in revenues from increased recreational use.[b]

The increase in guided and unguided users would provide economic benefits and jobs for the local economy, primarily the city of Kodiak. Businesses that provide lodging, food, sporting goods, and related services for recreationists would benefit. Air taxi operators and transporters, in particular, would expand their businesses as a result of the increased numbers of people traveling to and from the refuge. Some commercial fishermen would probably provide transportation services to visitors when they are not fishing. Increased tax revenues also would be generated for the city of Kodiak. The overall effect on the economy of Kodiak, however, would be minor.

The other villages on the island would experience minor economic benefits as a result of the increased use of the refuge. Residents of five of the villages already provide some services to hunters and sport fishermen. Even a small increase in cash flow in these small villages would be significant. The villages could also accrue some benefits if they charge fees for use of their lands or develop their lands to provide opportunities for recreationists using the refuge. The villages of Karluk and Larsen Bay in particular could realize additional income if visitors continue to pay fees to fish on the Karluk River. Businesses in these villages also could accrue some benefits as they are primary access points for recreationists floating down the Karluk River. These benefits may be largely offset, however, by the increase in costs necessary to manage village lands, such as managing fish and wildlife, maintaining facilities, and administering fee systems.

Overall, the Alternative A scenario would have a minor long-term positive economic benefits for the local economy. Commercial guides and outfitters would substantially benefit from increased use. Increasing numbers of recreationists would provide minor benefits to the city of Kodiak, particularly recreation-related support businesses. The economic impact on the other local villages would be minor.

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[a] All of the projected dollar values stated in the assessment are in 1985 dollars. See the general public use assumptions in the beginning of this chapter for the assumptions used in calculating these values.

[b] This figure does not include the revenues big game guides would collect from bear hunting. Assuming an average fee of \$8,000/client/trip, with each client going on an average 10 day hunt, the guides would take in \$800,000 from 100 bear hunters. This figure would remain constant in all of the alternatives because the number of guided bear hunters does not change.

Subsistence/Section 810(a) Evaluation and Finding

The following section examines the impacts on subsistence that would result from the Alternative A scenario. It also conforms to the guidelines recommended by the Alaska Land Use Council for complying with Section 810 of ANILCA. Similar evaluations and findings are included for each alternative discussed in this chapter.

Local residents have traditionally relied on marine resources and salmon for subsistence. These resources are harvested by local residents primarily in salt water, outside of the refuge. More recently, deer have become widely available on the island and have been harvested by local residents.

None of the actions considered in this alternative would affect marine resources outside of the refuge. Increasing numbers of recreationists would have a negligible impact on the salmon and deer habitats and populations in the refuge. Although more deer hunters and sport fishermen would harvest more animals, the availability of the populations for subsistence harvests in the refuge would not be affected. Native lands are available for subsistence harvests that could be closed to sport hunting and fishing. Sport fishing on the Karluk River could potentially affect subsistence harvests, but the Koniag Regional Corporation is expected to continue to manage use on the river to ensure that subsistence harvests are maintained. The Service would work with ADF&G, the state Fisheries and Game Boards, which regulate harvest levels, and the Native corporations to ensure that subsistence harvests on the refuge are maintained.

Alternative A would not affect the subsistence needs of local residents--there would be neither an increased need for subsistence nor a decreased need, relative to 1984. Subsistence activities would continue to be an important part of many local residents' lives.

The increases in public use would increase local residents' concerns about maintaining their subsistence way of life. Increased competition could be perceived for salmon on the major rivers and for limited access or camping spots. Trespass on Native lands could also increase with more people using the refuge. Although the Service would work with adjacent landowners and visitors to minimize conflicts, local residents may still perceive that increased numbers of refuge users are interfering with their subsistence activities.

Availability of Other Lands - Section 810(a) requires that the availability of other lands and other alternatives be considered in evaluating the effects of each refuge management alternative on subsistence uses. This plan addresses the general suitability of a broad range of activities for refuge lands. Thus although there may be other lands available for the uses considered, lands outside of the refuge are not considered because they are beyond the scope of this plan.

The Kodiak Refuge management alternatives and scenarios focus primarily on public use. The refuge attracts visitors because of its special features, such as the Kodiak brown bear, its diversity of fish and wildlife, its wilderness qualities and primitive recreation opportunities. There are other areas on Kodiak Island that could provide opportunities for public use similar to the refuge, but access to these areas is limited. Most of the other lands are either patented or Native lands not managed by the Service--the availability of these lands for public use depends on the actions of the landowners.

Other Alternatives - Four management alternatives were developed for Kodiak Refuge. Each of the alternative provides for varying increases in the level of public use. The Alternative A scenario lies towards the middle of the spectrum, providing opportunities for public use to double. One alternative would provide for a substantial increase in public use, one alternative would provide for about the same level as Alternative A, and one alternative would provide for a smaller increase. Increasing public use may increase local residents concerns about maintaining subsistence harvests in all of the alternatives, but none of the alternatives would adversely impact subsistence activities outside the refuge, where local residents harvest most of their resources.

Findings - The increase in public use in the Alternative A scenario would mean that more hunters would harvest deer and more fishermen would harvest salmon in the refuge than presently occurs. Local residents depend primarily on marine resources which would not be affected by actions on the refuge. Although local residents may perceive increased competition in their subsistence activities in the refuge, the alternative would not adversely affect either deer or salmon habitat and populations or harvests of other resources on non-refuge lands. Thus, the Service concludes that Alternative A would not result in a significant restriction of subsistence use.

Recreation

Under the Alternative A scenario all levels of public use would increase above the 1984 level: the number of clients of guides and outfitters would increase from the current level of 850 people to about 3,600 people by 1995, while unguided use would double from 6,550 people to 13,100 people in 1995. As a result of these increases potential user conflicts and perceived overcrowding could occur, primarily on popular sport fishing streams and deer hunting areas on the west coast during the months of September through December.

With increased numbers of recreational users visiting the refuge, the potential for bear-human encounters will increase in this alternative. There is a greater likelihood that most of these encounters will result in adverse consequences to the bears than to people. Kodiak Refuge has never had a fatal mauling. But with increased numbers of encounters the potential for maulings and loss of life would increase. In spite of the Service's efforts to prevent these incidents, there eventually would be maulings or deaths of people in the refuge.

Hunting - The alternative would not affect the level of brown bear hunting in the refuge. The current level of 15 big game guides taking 100 bear hunters on the refuge is not expected to change in the foreseeable future. More resident bear hunters may hunt on the refuge, but the increase from the present probably would be minor. Hunters are expected to continue to be able to harvest large bears, including trophy-sized bears.

Although the scenario projects that guides would expand operations from traditional bear hunting to include guiding for trophy deer and mountain goat hunting, the 1995 projected level of 200 guided hunters would remain a very small proportion of total refuge hunting use. Guided deer hunting would be expected to have a negligible effect on both harvest levels and potential user conflicts.

The number of outfitted clients is projected to increase from about 200 in 1984 to 1,600 in 1995. Most of this use would be outfitted deer hunts on the northwest portion and west coast of the refuge from September through December. The number of unguided deer hunters also would double from about 2,000 in 1984 to almost 4,000 in 1995. The increases in outfitted clients and unguided deer hunters are not expected to affect the overall availability of deer on the refuge--assuming there are no severe winters, hunters should be able to find deer. Increased numbers of outfitted and unguided hunters would compete with each other, as well as with other groups, for transportation, and limited campsites and access points near popular deer hunting locations. Limitations on the number of outfitters permitted to operate in given areas on the refuge would help reduce potential user conflicts, but competition with other guided and unguided groups still is expected to increase. Outfitted clients may displace unguided clients in the competition for limited numbers of campsites in popular hunting areas (e.g., Viekoda Bay, Spiridon Bay and Peninsula, Uganik Bay and Lake, and Uyak Bay).

Sport fishing - In the scenario the number of guided sport fishermen would rise from 550 currently to 1,800 in 1995. The number of unguided sport fishermen using the refuge also would double from about 2,300 in 1984 to 4,600 in 1995. These increases are not expected to affect the size of the sport fish populations.

With fishermen staying relatively short periods of time at one location and fishing pressure spread out over several drainages, the overall effect of the increase in sport fish guiding and unguided use are expected to result in minor user conflicts. Fishermen would continue to be able to catch large numbers of salmon in a primitive setting, and although more people may be present the numbers should not adversely affect users' desires to fish here.

As noted in the biological assessment, the projected increase in sport fishing pressure could adversely affect the refuge's rainbow trout, steelhead, and chinook populations. The state Fisheries Board would be expected to take action to limit harvests of these species if necessary. Limited access opportunities in the fall and bad weather also are expected to limit the impact of sport fishing pressure on the refuge's steelhead populations.

On the more heavily used rivers, including the Ayakulik/Red, Uganik, and possibly the Karluk rivers the increase in guided and unguided use could result in increased crowding and congestion, and conflicts with other user groups for campsites, access points, and desirable fishing spots. Increased overnight and day use by sport fishermen on the Ayakulik/Red River during the chinook run in mid-June to mid-July would probably result in more sport fishermen perceiving the river to be overcrowded relative to the present. On the Uganik Lake and River sporadic "heavy" use by day use fishermen during the midsummer also could result in perceived overcrowding. Some fishermen seeking a pristine wilderness fishing experience could be displaced from these rivers to other rivers in the refuge or outside the refuge.

Nonconsumptive Uses - Wildlife observation and photography are the primary nonconsumptive uses on Kodiak Refuge, occurring mostly in the summer. As stated in the general public use assumptions, the number of nonconsumptive users visiting the refuge would account for a small but expanding proportion of overall use. With increased numbers of sport fishermen in this alternative, nonconsumptive users may encounter increased competition to find desirable campsites or reserve cabins. The Alternative A scenario would not affect the number of nonconsumptive users (who do not engage in fishing or hunting)--the relatively small number of visitors that come to the refuge just to view wildlife would continue to be able to see bears and other wildlife.

Cultural Resources

The Alternative A scenario projects over a 100% increase in public use of the refuge, but no significant additional development of facilities for recreation or other purposes. The impacts of increased public use would be more diffuse than the impacts of developing facilities or other land modifications, in that the complete destruction of a site(s) would be unlikely, but damage would be more pervasive. Many sites may be damaged through unauthorized collection or casual vandalism; while individually these impacts may be minor, the overall result may be a moderate adverse impact on the cultural resources of the refuge as a whole. Even with protective stipulations in special use permits and additional education and enforcement efforts, increasing public use is expected to result in a moderate impact to cultural resources--degradation and loss of valuable cultural resources on the refuge would continue and accelerate. If artifact collecting continues to increase, as indications suggest, severe localized impacts could be experienced.

Wilderness Values

The increase in public use is not expected to adversely affect most refuge wilderness values. The wilderness values in most of the interior would continue to be maintained, with only a few people staying short periods of time. On the major lakes, drainages and other access points, and at the cabins the increased numbers of users in this scenario could adversely affect peoples' perceptions of wilderness--increased crowding at these points would result in fewer opportunities for solitude, increased littering or other signs of people, and generally diminish the wilderness experience of some users. On the refuge coastline the presence of commercial set net facilities and temporary guide or outfitter facilities also could aversely affect users' perceptions of wilderness values.

Wilderness Designation Effects of Alternative A

Under Alternative A none of the refuge would be proposed for wilderness designation. Most of the refuge would be included as minimal management areas during the life of the plan. The Service would manage the refuge as indicated in Table 15--all of the uses shown in the table that are compatible with refuge purposes would be permitted. With no designated wilderness in this alternative the Service would retain maximum flexibility for managing the refuge in the future. With revisions to the plan the Service could make areas available for land exchange, or develop areas for increased public use or economic uses that might not protect wilderness values but would be compatible with refuge purposes.

Summary of the Effects of Alternative A

Under the Alternative A scenario an increase in both the level and intensity of public use is anticipated, with the number of refuge visitors more than doubling by 1995. Impacts to most fish and wildlife resources would range from negligible to minor, with no species or populations threatened. Three possible exceptions to this conclusion would be refuge steelhead, rainbow trout, and chinook salmon populations, which could experience major long-term impacts from increased refuge sport fishing (and in the case of chinook increased interception of offshore refuge stocks from commercial fishing). Commercial salmon harvest and escapement levels for the refuge are expected to remain at or near 1981-1984 levels. An increase in non-sport bear mortality (i.e., DLP kills) is expected as a result of increased public use and displacement from key feeding areas along streams in the southwestern portion of the refuge. Impacts are expected to be negligible refuge-wide, however.

The above impacts do not take into account the impacts that would result from the synergistic interaction of other activities and developments on adjacent private lands. These potential cumulative impacts could significantly elevate the magnitude of all of the impacts described above, particularly to bald eagles and brown bear. The following activities or developments all would affect the expected magnitude of impact to the refuge populations:

- increased deer hunting (from September through December);
- increased sport fishing (primarily from June through September);
- the use of recreational cabins year-round (9 presently exist);
- operation of 54 shore-based commercial fishing sites (from May through September or potentially longer);
- development of patented lands, Native allotments, Protection Level III Native lands, and other private lands adjacent to the refuge.

While most key bald eagle habitats would be protected within the refuge in the alternative, the cumulative impacts of development outside of the refuge could adversely affect the refuge's bald eagle population. The most pronounced effects of development would be disturbance to nesting. Similarly, development of private lands adjacent to and within the refuge boundary, combined with increased public use in the refuge, presents a potentially serious threat to local brown bear populations--particularly development that results in year-round occupancy. Mortality levels would increase, with additional DLPs and displacement from key habitats above the levels already noted.

Several socioeconomic impacts are expected as a result of the alternative. An increase in the number of commercial guides, outfitters, transporter, and other recreation related businesses are expected to result in minor benefits to the local economy in the form of additional employment and cash flows in the community of Kodiak. Refuge-based salmon stocks are expected to continue to contribute an average annual ex-vessel value of $12.3 million to Kodiak Island commercial fishermen. Subsistence opportunities would be maintained, although increased sport fishing and hunting could be perceived by local residents to interfere with their subsistence activities. Increased numbers of refuge users would result in more intense competition for popular sport fishing and hunting areas and access points. Visitor satisfaction probably would be somewhat lower consequently compared to the current situation. (Brown bear hunters would be an exception to this as the number of permits is expected to remain constant.) The potential for bear maulings and deaths of people would increase as more people used the refuge. Wilderness values are expected to be maintained, but somewhat diminished in heavily used areas. Some losses of cultural resources are expected due to site vandalism and artifact collecting from increased public use.

ALTERNATIVE B

Scenario

In the Alternative B scenario the Service would provide additional opportunities for public use on part of the refuge. Assuming more people visit the refuge in this scenario, additional sport fish guides and outfitters would be permitted to operate in the refuge. The outfitters also would be permitted to use tent platforms along the coast (including the heads of bays), on the Spiridon Peninsula and Uganik Island, and in three other moderate management areas. The Service would increase the number of public use cabins and provide developed campsites to encourage public use. These facilities would be in the moderate management areas on the northwest portion of the refuge and would be primarily used by deer hunters. About 75% of the refuge would be designated as wilderness. As a result of these actions total public use would increase to 20,500 people in 1995--about a 23% increase over Alternative A.

Both guided and unguided use levels would increase in this scenario, relative to Alternative A. Guided and outfitted use would almost double, compared to Alternative A, due to the presence of more guides and outfitters, and the use of more tent platforms. These groups would account for a significant proportion (33%) of overall use compared to 1984 use levels. Unguided use would increase over the levels estimated in the Alternative A scenario because of the additional cabins that would be available. Use levels in 1995 are estimated as follows:

- Big game guiding, including bear, mountain goat, elk and and deer hunting, would remain at the same levels assumed in the Alternative A scenario.
- The number of outfitters using the refuge would increase to 36, an 80% increase relative to Alternative A; the number of clients would almost double, increasing to 2,900. Seventeen of the outfitters would operate on coastal areas in the moderate management areas, of which 11 would be permitted to use either use commercial fishing cabins or tent frames and 6 would be permitted to use tent frames at the heads of bays. These 17 outfitters would be permitted to operate on the refuge for the season of use. Thirteen other outfitters would be permitted to operate in the interior of the refuge, using tents only. These outfitters would stay at one location up to 7 days. Six more outfitters would be permitted to use tent platforms in the moderate management areas in the northwest part of the refuge: 3 outfitters would operate on Uganik Island and 3 outfitters would operate on the Spiridon Peninsula.
- Sport fish guiding use would double, relative to Alternative A, with the number of guides increasing from 18 to 36 in 1995. Up to three guides would have permits to take clients out overnight on each of the drainages in the refuge. All sport fish guides would be able to use the entire refuge for day use activities. The guided parties in the interior of the refuge would stay in tents up to 7 days at one location. Sport fish guides using moderate management areas may be permitted temporary facilities for their operations.

- Five new public use cabins and four campsites would be provided for unguided users in the moderate management areas. The campsites would consist of leveled areas for tents, fire rings, food caches, and outhouses. The cabins and campsites would be built on Uganik Island, the Spiridon Peninsula, and on lagoons and sheltered peninsulas on the refuge's northwest coastline. With the provision of these facilities it is expected that overall unguided use would increase slightly over Alternative A: assuming 80 people use each facility over the course of one year, 700 additional unguided users would come to the refuge in 1995.

- Although the relative proportion of sport fishing use in the drainages is assumed to remain the same in Alternative B as in Alternative A, the increase in guided and unguided sport fishing in Alternative B would mean an increase in fishing pressure on all of the drainages.

Biological Effects of Alternative B

Fish

Under Alternative B, all key overwintering, spawning, and rearing aquatic habitats except one for both anadromous and resident fish species would be under minimal management. The exception would be the Little River system on the Spiridon Peninsula which would be under moderate management.

Under this scenario, most management and research activities on the refuge would be expected to have a negligible impact on habitat values. New fish weirs installed on several minor sockeye systems are expected to have a negligible impact on the aquatic habitat. If artificial fertilization of Karluk Lake occurs, however, there could be major impacts to the survival of juvenile sockeye while in fresh water. This could lead to reduced smolt size and possibly decreased marine survival and total recruitment (see the fish assessment in Alternative A).

Commercial harvest and escapement levels for refuge-based salmon stocks in this scenario for Alternative B should continue to support the overall goals for natural stocks in the Kodiak Management Area, as defined in ADF&G's Kodiak Regional Comprehensive Salmon Plan-2002 (1984). With the exception of even year pinks, the 1981 to 1984 refuge wide total returns for all salmon species are within approximately 10% of the Year 2002 goals set by ADF&G. Given favorable conditions in both the freshwater and marine environments, the natural refuge-based pink, chum, sockeye and chinook stocks should remain at or near 1981 to 1984 levels. Commercial fishing is expected in this scenario to have negligible impacts on the age structure and recruitment potential for both odd and even-year pink, chum, sockeye and chinook salmon.

Under this alternative, efforts to enumerate coho escapement through increased aerial indexes and the installation of additional weirs on minor sockeye systems are expected to provide the data base that was considered lacking under Alternative A. With a projected total return of 109,000 coho in 1995 and an escapement of 54,000 fish, commercial fishermen would harvest about 55,000 fish. This projected harvest level would have a minor impact on refuge stocks.

Sport fish harvests of refuge based stocks would be expected to increase under the Alternative B scenario to levels above those described in the Alternative A scenario. Sport fishermen are projected to harvest approximately 10,000 coho in 1995 under this scenario. Assuming the commercial fish harvest management takes into account the sport harvest, this projected harvest level is expected to have a minor impact on refuge coho stocks.

The average total returns of chinook are estimated at approximately 11,000 fish from 1985 to 1995, with an average total escapement of 9,000 chinook; commercial fishermen would harvest 2,000 fish harvest outside of the refuge. Approximately 57 and 42 percent of the total escapement would be destined for the Karluk and Ayakulik Rivers, respectively. For the purpose of this analysis these systems are combined and considered as one. Sport fish harvest estimates for chinook on the refuge from guided and unguided visits are projected to result in a combined harvest of approximately 10,000 chinook. The in-river harvest and commercial offshore harvest combined is estimated at about 12,000 fish. This results in an exploitation rate that would decimate the return to the refuge within one cycle and would represent a major long-term impact.

If harvest levels increase as anticipated in Alternative B, there could be a major long-term impact to the refuge's steelhead stocks.

The effects of a sport fish harvest of 840 steelhead projected for this alternative is difficult to predict. Although a total estimated population range of 5,300 to 15,000 steelhead is suspected on the refuge, absolute population numbers are unknown. The complex life history characteristics of steelhead, such as the fact that repeat spawners may constitute between 16 and 43% of the total run, makes projections of harvest impacts difficult. There is an unknown hook and release mortality due to poor handling of steelhead caught by anglers. It is anticipated that if harvest levels increase from less than an estimated 200 fish in 1984 to 840 fish projected under this scenario in 1995, a major long-term impact could occur to refuge steelhead stocks.

As with steelhead no baseline data are available to analyze the effects of harvesting 840 rainbow trout. It is suspected that this harvest could cause a major long-term impact on rainbow populations because most rainbow trout populations on the refuge are extremely small localized stocks that could not withstand any sustained harvest for more than one generation.

The harvest of 2,000 char from refuge populations is expected to have a negligible impact on the overall population. Although the total population level is unknown, char appear to be relatively abundant throughout the refuge and can probably sustain this higher harvest level than that projected in the Alternative B scenario.

Waterfowl

Overall, long-term impacts to waterfowl under the Alternative B scenario would be minor to moderate. Higher levels of guided and unguided public use along the Red/Ayakulik River would likely result in greater disturbance of key upstream waterfowl nesting habitat. Crowding along the more accessible lower river would cause more people to expend the extra efforts required to get upstream away from the crowds. Approximately 85% of the refuge's nesting tundra swan population are found in this area and could be adversely effected by additional disturbance. Increased numbers of outfitters and recreational guides projected in this alternative also would likely affect coastal waterfowl habitats of the inner bay and tidal flat areas in the moderate management areas. As more accessible outer bay areas become crowded, guided and unguided user activity and disturbance will shift toward inner bay and tidal flat areas.

Increased public use of the Spiridon Lake area under moderate management could cause excessive disturbance and possible abandonment of nesting territories of several pairs of tundra swans known to use this area.

Shorebirds

Generally, impacts would be minor but likely long-term for shorebird populations using the refuge under this scenario. Shorebird nesting and feeding along the Red/Ayakulik River likely would be reduced. Increases of both guided and unguided users would result in a larger portion of the drainage to be used, increasing the chances of disturbance to shorebirds nesting along the river and associated backwaters. Coastal inner bay and tidal flat areas under moderate management of this alternative would also experience adverse effects to feeding and migrating shorebirds resulting from increased public use support facilities and facility construction described for waterfowl.

Raptors

Moderate management of the entire refuge coastline under this alternative would expose the majority of the refuge's nesting bald eagles and other coastal nesting raptors to impacts from greater use levels by both commercial and noncommercial users. There also would be a potential for increased disturbance to raptors in other interior habitats due to greater numbers of sport fish guides and outfitters allowed along all major drainages in this alternative. Increased power boat and airplane traffic could disrupt nesting and cause abandonment of nesting sites. Possible development of guide and outfitting operations in the inner bays and tidal flats would result in disturbance and reduce foraging habitat for bald eagles and other raptors. Overall, minor long-term impacts to refuge raptor populations would occur under the Alternative B scenario, with locally moderate impacts.

Marine Birds

Increases in guided and unguided use levels in this alternative could have detrimental effects on marine birds. Photographic and general sightseeing visits to nesting colonies from both guided and unguided users probably would increase under this alternative. Powerboat and airplane traffic along coastal areas also would likely increase. Egg and chick loss from exposure, predation, stampeding, and other accidents resulting from disturbance would occur. Overall, impacts on marine bird populations are expected to be minor, with possible localized moderate impacts.

Marine Mammals

Alternative B would have the same minor effect on marine mammals as Alternative A.

Deer

No long-term impacts are expected to the refuge's deer population would be expected in this alternative. Although hunting pressure would be greater than in Alternative A, the inaccessibility of much of the refuge would continue to limit the effect of hunters on the deer population. Some short-term impacts would occur in localized areas where hunting activity is concentrated. Increased hunting pressure on Uganik Island and the Spiridon Peninsula could result in minor to moderate impacts to those deer populations.

Deer hunting could have a positive benefit for deer habitat in localized areas. If the deer population were ever to increase to the point it could overbrowse an area, deer hunting would relieve overbrowsing by excessive deer.

Brown Bear

Relative to Alternative A, Alternative B has the potential for increased impacts on localized populations of brown bear. The effects of shore-based commercial fishing and big game guiding should remain negligible. Impacts from increased public use would remain negligible to minor on most interior portions of the refuge but could reach moderate levels on Uganik Island, Spiridon Peninsula and several bays in the northwest portion of the refuge.

Under moderate management, the cumulative effects of increased public use would result in minor impacts to brown bear on refuge lands north of Larsen Bay, on the east side of the refuge, on Uganik Island and on lands adjacent to Spiridon, Zachar, and Uganik (South and Northeast Arms) bays. Moderate level impacts would occur to populations of bear using the Spiridon Peninsula and areas bordering Deadman, Uganik (East Arm), Uyak and Terror Bays.

The most significant impact to bear is expected to be defense of life and property (DLP) mortality. The near doubling of the number of outfitted clients (mostly deer hunters) and increase in unguided deer hunters from September through January probably would be the most important causes of DLPs--hunting/camping related activities (i.e., cooking odors, meat storage, trash disposal) would all combine to serve as a major attractant to some bears. Unreported mortality or wounding of bears by deer hunters is already considered to be a potentially serious problem. DLP mortality related to other human activities (sport fishing, wildlife viewing, photography) is expected to be a lesser but nevertheless important cumulative factor. DLP mortality could reach levels that would cause the Alaska Board of Game to reduce the number of brown bear permits allocated to sport hunters.

Conflicts between the general public and commercial operator camps in this alternative would undoubtedly result in a shift of public use patterns to more interior portions of the refuge to avoid or minimize such conflicts. This would place even more pressure on key habitat areas of high bear density, resulting in additional DLPs and extirpation of some segments of local bear populations.

The effect of sport fishing and nonconsumptive uses such as wildlife viewing and photography on bears would be greater in the Alternative B scenario than in Alternative A due to the higher levels of public use projected for Alternative B. As in Alternative A, the effects of these activities should be most pronounced in the southwestern portion of the refuge. Key feeding concentrations of bear that occur in parts of the Ayakulik River, Sturgeon River, Dog Salmon Creek, Frazer Lake and Karluk Lake drainages would be disrupted by high or continuous use by humans. Continuous human activity at specific locations would lead to minor or possibly moderate impacts on local populations.

The cumulative effects of bears encountering increased human use from previously occupied habitats on Kodiak Refuge are largely unknown. However, certain direct and indirect effects should be considered as potentially significant to localized populations. An increase in DLPs would be one of the direct results of increased human activity. Another direct result would be the displacement of bears: animals would be displaced from areas due to high human activity levels over extended time periods. Expanded human activity could disrupt important seasonal concentrations of bear that occur near the heads of Uyak, Deadman, and Terror Bays. Bears seeking to avoid areas of intensified human use would likely move into already occupied habitats, thus increasing the potential for intrapopulation stress. Indirect effects likely would be manifested in increased competition for food, lowered protein base (salmon), and higher expenditures of energy in search of food - all resulting in a net loss of productivity, reduced litter size, higher mortality of young, and a lower percentage of younger sows bearing cubs.

In summary, the Alternative B scenario would have a negligible to minor impact on brown bears in interior portions of the refuge managed as wilderness. Impacts could range from minor to moderate on Uganik Island and Spiridon Peninsula and would be moderate on segments of the bear population that use the heads of Deadman, Uyak, Spiridon, and Terror bays.

Water Quality/Quantity

Impacts from increased public use would be confined primarily along the major river systems and popular access points. Because of the seasonal nature of public use activities likely to affect water quality (primarily sport fishing), the range and level of impacts are expected to be minor. Streambank erosion probably would be at a higher level under this alternative but the natural withstanding capacities of the refuge's waterbodies should be sufficient to offset these changes. Water quantity would not be affected or altered in this alternative.

Socioeconomic Effects of Alternative B

Population

Under the Alternative B scenario the Service would increase recreational use of the refuge and provide for increased production of salmon in the refuge. In the scenario recreational use would almost triple by 1995. The effect of this increase on the population of the local communities would be negligible, the same as Alternative A. During the fishing and hunting seasons there would be an influx of visitors coming into the city of Kodiak. This increase would affect the seasonal population of the city, but the effect on the permanent population would be negligible. The populations of the other communities would not be significantly affected.

Economy

The primary economic effects of the Alternative A scenario would be due to the increase in public use of the refuge. This scenario projects the maximum increases in guided, outfitted and unguided use of all the alternatives considered. With the number of guided sport fishermen doubling from Alternative A to Alternative B, and the number of outfitted clients increasing by 81%, the number of jobs for guides, outfitters and their staff would increase. More revenues would be generated from guided sport fishermen and outfitted clients in this scenario:

- Sport fish guides would collect an estimated $3.6 million from 3,600 clients, a 100% increase over Alternative A.[a]

- Outfitters would collect an estimated $3.6 million from 3,600 clients in 1995, a 61% increase over the Alternative A scenario.

- Big game guides would receive an estimated $300,000 from 100 guided deer hunters, the same as Alternative A.

Thus, under this scenario guides and outfitters would receive an estimated $7.5 million in revenues (excluding revenues derived from bear hunting) from increased recreational use--a 72% increase over the Alternative A scenario.

The increase in recreational use would provide additional seasonal economic benefits and jobs for the local economy, primarily the city of Kodiak. Commercial guides and outfitters and unguided users would spend more money in this scenario than in Alternative A on food, sporting goods, lodging, transportation, and other services. Businesses that provide these services for recreationists would benefit. Air taxi operators and transporters, in particular, would substantially expand their businesses to accommodate the increased numbers of people traveling to and from the refuge. More commercial fishermen would provide transportation services to visitors in this alternative. Increased tax revenues also would be generated for the city of Kodiak. The overall effect on the economy of Kodiak, when compared to other revenue sources, would be minor.

The other villages on the island would experience minor economic benefits from increased use of the refuge, the same as Alternative A. Most visitors probably would not stop in the villages. However, even a small increase in cash flow in these small villages would be significant. The village economies could potentially receive more benefits, particularly Karluk and Larsen Bay, with increased numbers of visitors using village corporation lands or if services were specifically developed for visitors. Increased recreational use also could result in higher economic costs to the villages due to increased management costs (e.g., preventing trespass on Native lands, administering fee systems, maintaining facilities, and managing fish and wildlife).

Overall, the Alternative B scenario would have about the same effect on the local economy as Alternative A: minor long-term positive economic benefits for the local economy. Commercial guides and outfitters would substantially benefit from increased use. Increasing numbers of recreationists would provide minor benefits to the city of Kodiak, particularly recreation-related support businesses. The economic impact on the other local villages would be minor.

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[a] See the general public use assumptions in the beginning of this chapter for the assumptions used in calculating these values.

Subsistence/Section 810(a) Evaluation and Finding

None of the actions considered in this alternative would affect subsistence activities outside of the refuge. The harvest of marine resources, the resources most important to local residents for subsistence purposes, would not be affected by increased refuge use.

Increasing numbers of recreationists would have a negligible impact on the habitats of important subsistence species. The higher number of deer hunters is not expected to affect the availability of deer in the refuge--local residents would continue to be able to find deer to satisfy their subsistence needs. Local residents also should be able to continue to harvest the salmon they need in the refuge. Most of the salmon harvested by local residents occurs in salt water, outside of the refuge. Furthermore, most of the rivers where sport fishing is expected to increase would not be heavily used by local residents. On the Karluk River chinook salmon and steelhead populations may become more scarce in the upper stretches due to increased sport fishing, but these fish are not used as extensively for subsistence purposes as other salmon. Competition also could increase in this scenario on the Karluk River for limited access or camping spots. The Koniag Regional Corporation is expected to continue to manage the Karluk River to ensure that opportunities for subsistence activities are maintained. The Service would work with the Native corporations, ADF&G and the state Fish and Game Boards, which regulate harvest levels, to ensure that subsistence harvests on the Karluk River are maintained.

Alternative B would not affect the subsistence needs of local residents--there would be neither an increased need for subsistence nor a decreased need, relative to 1984. Subsistence activities would continue to be an important part of many local residents' lives.

With 20,500 sport fishermen and hunters using the refuge in this scenario (an increase of 23% over Alternative A in 1995), local residents' concerns about maintaining their subsistence way of life would increase over those in Alternative A. Trespass on Native lands would also likely increase with more people using the refuge. Although the Service would work with adjacent landowners and visitors to minimize conflicts, local residents probably would perceive that increased numbers of refuge users are interfering with their subsistence activities on popular rivers and coastal areas.

Availability of Other Lands - As noted in the Section 810(a) evaluation for Alternative A, there may be other non-refuge lands available for public use but lands outside the refuge are beyond the scope of this plan. There are other areas on Kodiak Island that could provide opportunities for public use similar to the refuge, but access into these areas is limited. Most of the other lands are either patented or Native lands not managed by the Service--the availability of these lands for public use depends on the actions of the landowners.

Other Alternatives - The Alternative B scenario provides for the highest level of public use considered in the four alternatives. Three other alternatives were considered that would provide for smaller increases in public use. Increasing public use would increase local residents' concerns about maintaining subsistence harvests in all of the alternatives, with this alternative generating the highest concern.

Findings - The increase in public use in the Alternative B scenario would mean that substantially more hunters and fishermen would harvest deer and salmon in the refuge than presently occurs. Local residents depend primarily on marine resources that would not be affected by actions on the refuge. Although perceived competition for deer and salmon would increase, the alternative would not adversely affect either deer or salmon populations and habitats--deer and salmon should be available in adequate quantities for local residents to satisfy their subsistence needs. Thus, the Service concludes that Alternative B would not result in a significant restriction of subsistence use.

Recreation

The Alternative B scenario projects the highest levels of public use considered for the four alternatives, 20,500 visitors, a 23% increase over Alternative A (ard a 177% increase over the level of use in 1984). The number of guided fishermen would double in 1995 relative to Alternative A, while the number of outfitted clients would increase by 81% and unguided users by 5% (Table 22). The Service would provide five more public use cabins and four campsites in the scenario, which would enable more people to come to the refuge and hunt, fish, and enjoy the refuge. Higher user levels would increase the potential for user conflicts and overcrowding, particularly on popular sport fishing streams and deer hunting areas on the northwest coast.

In this alternative more outfitted and sport fish guided groups would occupy camping areas on the northwest side of the refuge, and on some interior lakes and rivers. These camps would tend to exclude the general public from some major access points and camp sites because most recreationists would not camp next to another camp, particularly a commercial operator's camp. For example, if outfitters set up long-term camps on Spiridon and Little River lakes they could nearly exclude the general public from using these areas because of limited desirable camp sites. In other areas the general public would be forced further into the interior of the refuge or to marginal sites along the coast to avoid conflicts with commercial operators and to find unoccupied camping and access sites.

The economics of running an outfitting camp or guiding operation would lead many operators to seek areas that offer more than one type of recreational opportunity. The most likely sites for these "combination camps" would be the heads of bays, where deer and bear hunting, fishing, photography, duck hunting, and clam digging would all be possible. These camps would be occupied over a longer season of use than other single purpose camps.

With increased numbers of recreational users visiting the refuge, the potential for bear-human encounters will be higher in this alternative than in Alternative A. There is consequently an increased potential for maulings and loss of life. In spite of the Service's efforts to prevent these incidents, there eventually would be maulings or deaths of people in the refuge.

Hunting - The level of guided hunting would not change in this alternative from Alternative A. Although the number of bear-human encounters and bear mortality could increase with increased numbers of refuge users, bear hunters still should be able to harvest large bears, including trophy-sized bears, in this alternative. Increased competition could occur between guided hunters and other hunters for limited campsites. Increased numbers of deer hunters and fishermen also may affect bear hunters' perceptions of crowding and the quality of the experience.

The scenario projects 2,900 outfitted visitors (most of whom are deer hunters), 4,100 unguided deer hunters and 200 guided deer hunters in 1995. The increases in outfitted clients and unguided deer hunters are not expected to affect the overall availability of deer on the refuge--assuming there are no severe winters, the additional hunters should be able to find deer.

Increased numbers of outfitted and unguided hunters also would compete with each other, as well as with other groups, for transportation, and limited campsites and access points near popular deer hunting locations. Guided deer hunters would tend to go to more remote portions of the refuge and would have a negligible effect on both harvest levels and potential user conflicts. Most deer hunters would focus their efforts closer to the city of Kodiak, on the northwest portion of the refuge from September through December. Native ownership of easily accessible areas and poor weather would limit deer hunting opportunities in other coastal areas. The presence of additional cabins and outfitter temporary support facilities also would concentrate use in the northwest part of the refuge. Deer hunters already perceive competition in hunting areas on the northwest coast of the refuge. With increased numbers of hunters, fishermen and other visitors, increased competition for campsites, cabins and access points, and a higher potential for overcrowding, the quality of the recreational experience for most hunters would decline relative to Alternative A. Areas where these impacts would be likely include prime access points and campsites on Uganik Island, Viekoda Bay, Uganik Bay, Little River Lake, Spiridon Lake, and Campbell's Lagoon. Overall, in this scenario increased numbers of hunters would harvest deer in the refuge, but user satisfaction in the quality of the hunt would decline relative to Alternative A.

Sport fishing - In the Alternative B scenario the total number of fishermen using the refuge in 1995 would increase by 32% relative to Alternative A, from 6,400 to 8,400 fishermen. As noted in the biological assessment, the increase in sport fishing pressure could adversely affect the refuge's chinook, rainbow trout and steelhead populations. The state Fisheries Board would be expected to take action to limit harvests of these species if necessary.

A total of about 2,500 fishermen would fish on the refuge's less popular drainages. With overnight use restrictions and use dispersed over several drainages, the overall effect of the increase in sport fish guiding and unguided use is expected to result in minor user conflicts. Fishermen would continue to be able to catch salmon in a primitive setting on these drainages, and although more people would be present than in Alternative A the numbers should not adversely affect users' desires to fish here.

On the refuge's four popular rivers (Ayakulik, Uganik, Karluk, and Dog Salmon/Frazer) the increases in guided and unguided fishermen would increase the potential for overcrowding, competition for limited campsites, access points, and desirable fishing spots. Fishermen camping overnight on the Ayakulik/Red River system would find themselves competing for five or six desirable campsites during the chinook salmon run. In addition, day users may target the Ayakulik River during this short time period, increasing crowding and competition for fish. Uganik Lake, which is a popular day use fishing location, would almost certainly experience periodic visitor conflicts and be perceived as overcrowded. More fishermen seeking a pristine wilderness fishing experience likely would be displaced from fishing locations or drainages in this scenario than in the Alternative A scenario.

Nonconsumptive Uses - The number of nonconsumptive users that would visit the refuge in this scenario would be about the same as in Alternative A. Visitors that come to the refuge just to view wildlife would continue to be able to see bears and other animals, but in this scenario nonconsumptive users would face increased competition with fishermen and hunters for desirable campsites and cabins during the hunting/fishing seasons.

Trash left by a group at a campsite on Spiridon Lake.

Cultural Resources

The general effects of increased public use under this scenario would be similar to, though presumably somewhat greater than, those described for Alternative A. The addition of public use cabins and campsites, as well as permitted facilities for guides and outfitters, would occur in areas of comparatively high densities of archaeological sites (e.g., along the coast near stream mouths). Presumably, these developments would be located so as to avoid direct damage to such sites. Nonetheless, impacts on the cultural resources of the adjacent areas would be moderate and perhaps locally severe due to the uncontrolled nature of the public use.

Wilderness Values

In most of the refuge interior, wilderness values would continue to be maintained in this alternative, with only a few people staying short periods of time. On the Uganik Island and Spiridon Peninsula increased numbers of users and the presence of cabins and other visitor support facilities would adversely affect some users' perceptions of the wilderness qualities in these areas. With more people on the major lakes, drainages and coastal areas in this scenario, the potential for crowding, littering, or other signs of people (e.g., increased numbers of temporary commercial set net facilities) would increase relative to Alternative A. Thus, the Alternative B scenario would have a higher potential to adversely affect users' perceptions of the refuge's wilderness values than Alternative A.

Wilderness Designation Effects of Alternative B

Under Alternative B most of the refuge interior would be proposed for wilderness designation. Wilderness designation would not be proposed for Spiridon Peninsula, Uganik Island, Ban and Afognak islands, and the refuge coastline.

Wilderness designation would provide long-term Congressional protection to fish and wildlife habitats in the refuge interior. The designation also would add to the National Wilderness Preservation System an area with unique biological, research, and recreational values.

Effects on Fish and Wildlife Management

Wilderness designation would not affect most management practices of the Service, as described in Alternative B. In the designated wilderness area the Service's management flexibility would be limited, in that Congressional approval would be needed for certain actions rather than an administrative change in the plan. The Service would emphasize the "minimal tool" concept in managing fish and wildlife, which would preclude certain actions (e.g., mechanical manipulation, development of permanent management facilities). Management objectives generally could be achieved using other techniques or using temporary facilities. Most fisheries management activities, except for new permanent structures, would be permitted in the wilderness area provided they are compatible with refuge purposes. Habitat restoration, and fish stocking could occur where compatible with refuge purposes. Artificial control of predators, insects, plant disease, and fire that threaten resources or people also could occur in the wilderness area. Wilderness designation would not affect hunting or fishing. No actions would need to be taken by the Service to mitigate or control potential impacts to fish and wildlife that could occur from the development of permanent facilities in non-wilderness areas.

Effects on Public Uses and Access

The designation would not affect sport hunting or fishing, subsistence uses, or access into the refuge--the Alaska Boards of Fish and Game would continue to regulate these activities. Wilderness designation could eventually increase public use of that portion of the refuge: more people would tend to come to a national wilderness area due to the special attention this conservation unit bestows on an area.

Effects on Commercial Uses and Permanent Facilities

Existing commercial uses, including guiding and outfitting, would not be affected by the action. The designation would preclude potential permanent facilities and commercial uses, such as hydroelectric facilities, roads, and logging. These uses would be precluded in the refuge, regardless of the wilderness designation.

Summary of the Effects of Alternative B

The Alternative B scenario projects a significant increase in public use relative to 1984 levels. By 1995 the number of refuge visitors would be expected to increase by nearly three-fold. Commercial harvest and escapement levels for refuge-based salmon stocks would generally support the overall goals for natural stocks in the Kodiak Salmon Management Area. Negligible impacts would be expected on the age structure and recruitment for pink, chum, sockeye and chinook salmon from commercial fishing. The near doubling of sport fishing use could have major long-term impacts on chinook, steelhead and rainbow trout. (In the case of chinook salmon, combined pressure from both sport and commercial harvests could hasten the time when the state Board of Fish would have to take action to protect these stocks.) Increased public use along the four major river systems would cause greater levels of disturbance to waterfowl, most notably nesting tundra swans in the upper reaches of the Red/Ayakulik system. Overall impacts to waterfowl would be minor, with the potential for moderate impacts in localized areas, including tidal flats, inner bays and lagoons in moderate management areas north of Uyak Bay. Minor impacts are expected to bald eagles, with the potential for locally moderate impacts to nesting and feeding eagles along major drainages in the southwestern portion of the refuge and heads of bays north of Uyak Bay.

With the increase in human use, additional public use cabins, and longer duration of human habitation in key brown bear concentration/feeding areas (e.g., the heads of six bays north of Uyak Bay, Spiridon Peninsula, and Uganik Island), moderate level impacts are possible to local populations. DLP mortality could reach levels of a magnitude causing the Board of Game to reduce the number of brown bear permits allocated to sport hunters.

Negligible to minor impacts are expected to more interior portions of the refuge. Impacts from development and use of lands adjacent to or within the refuge boundary would likely increase the magnitude of all the above potential impacts, as noted in the summary of impacts in Alternative A.

Alternative B would have several positive and negative socioeconomic consequences. The community of Kodiak would realize some increases in economic benefits due to expansion of recreation-related businesses. Outfitters and guides would substantially benefit from increased refuge use. Refuge-based salmon stocks would continue to contribute a substantial amount to the local economy. Subsistence opportunities would be maintained under the alternative, although projected increases in public use would heighten concerns among local residents regarding competition for subsistence resources. The projected expansion of public use also would probably adversely affect user satisfaction due to increased competition for space or fish and wildlife resources. This would be especially true in popular use areas. Most of the refuge's wilderness values would be maintained, although in higher use areas these values could diminish. The potential for bear maulings and deaths of people would increase as more people used the refuge. The potential for degradation of cultural resources is expected to increase with more intensive use in areas likely to have archaeological sites.

The wilderness proposal in Alternative B, if adopted, would provide long-term Congressional protection to Kodiak Refuge wilderness values and fish and wildlife habitats. The designation would add a unique area to the National Wilderness Preservation System. Recreational and subsistence hunting and fishing, and existing commercial uses would not be affected by the action. The designation would preclude certain commercial uses and permanent facilities, and could limit management flexibility. Most management practices, however, would not be affected by the action.

ALTERNATIVE C (PREFERRED ALTERNATIVE)

Scenario

In this scenario it is assumed that the Service would provide for a limited increase in public use. Additional sport fishing guides and outfitters would be permitted to operate in the refuge, relative to 1984 levels, but to reduce the potential for impacts to fish and wildlife the Service would limit the level of growth. Fewer moderate management areas would be available in this scenario than in the previous scenarios for outfitters to build and use tent platforms--no tent platforms would be permitted on the southwest coast, at the heads of most bays, or in interior locations in the refuge. No new facilities would be provided for public use. The Service would continue to maintain the 9 cabins on refuge lands, and the 2 cabins on Native lands also are assumed to be available for public use. Approximately 70% of the refuge lands would be designated as wilderness. Overall public use would increase to about 17,200 users in 1995 in Alternative C, a 3% increase over Alternative A.

As in the previous scenarios, most of the refuge use would be unguided (Table 22). The level of unguided use would not change from the level assumed in Alternative A. Guided use would increase slightly to 4,000 visitors, or 11% relative to Alternative A, because of the increase in sport fish guides permitted to operate on the refuge. Use levels in 1995 are estimated as follows:

- Big game guiding, including bear hunting and deer hunting, would remain at the same levels assumed in the Alternative A scenario.
- Eighteen outfitters would be permitted to operate in the refuge, two less than the number in the Alternative A scenario. These outfitters would have a total of 1,400 clients. Eleven of the outfitters would use tent platforms on selected coastal moderate management areas. They would be permitted to operate for the season of use. Seven of the outfitters would use tents in the refuge's interior, staying at one location up to 7 days.
- The number of sport fish guides would increase by 33% in this scenario over the number permitted in the Alternative A scenario. The 24 permitted guides would have 2,400 clients. Two guides would be permitted to operate over night on each drainage. The guided groups would use tents and would stay at one location up to 7 days.
- Sport fishing pressure on the refuge's drainages would increase in the Alternative C scenario, relative to Alternative A, because of the increased number of guided sport fishermen. The fishing pressure would be less than Alternative B, however.

Biological Effects of Alternative C

Fish

Under alternative C all key overwintering, spawning, and rearing aquatic habitats for both anadromous and resident fish species would be protected under wilderness or minimal management.

Under this alternative, most management and research activities on the refuge are expected to have a negligible impact on habitat values. New fish weirs would be installed on several minor sockeye systems and are expected to have a negligible impact on the aquatic habitat. If artificial fertilization of Karluk Lake occurs, however, there could be major impacts to the survival of juvenile sockeye while in fresh water. This could lead to reduced smolt size and possibly decreased marine survival and total recruitment (see the fish assessment in Alternative A).

The level of commercial fishing outside the refuge and resulting impacts would be the same in this scenario as in Alternative B. Given favorable conditions in both the freshwater and marine environments, the natural refuge-based salmon socks should continue to support ADF&G's long-range goals as set in its regional salmon plan. It is expected there would be negligible impacts on the age structure or recruitment potential for both odd and even year pinks, chum, sockeye, and chinook salmon. Minor impacts could occur from the commercial harvest of coho.

Sport fish harvests of refuge-based stocks are projected to increase in the Alternative C scenario to levels above those projected in Alternative A, but below levels projected in Alternative B. A sport fish harvest of 8,400 coho from refuge stocks is projected for this scenario in 1995. Assuming the commercial fish harvest management takes into account the sport harvest, this projected harvest level is expected to have a minor long-term impact on refuge coho stocks.

The average total return of chinook between 1985 and 1995 is projected at approximately 11,000 fish, with an average total escapement of 9,000 fish; commercial fishermen would harvest 2,000 fish outside the refuge. Sport fish harvest estimates for chinook on the refuge from guided and unguided visits is projected to result in a combined harvest of approximately 8,400 chinook. The in-river harvest and commercial offshore harvest combined is estimated at 10,400 fish. If no other actions were taken this harvest could decimate the total return to the refuge within one generation. However, designation of special River Management Areas on the Karluk, Ayakulik, Dog Salmon, and Sturgeon rivers and development of management plans for these systems would reduce the impact of sport fishing: with increased control of access and use levels and close monitoring of the fishery it is anticipated that sport fishing would have a minor to moderate impact on the refuge's chinook population.

As in the previous alternatives, the effect of the sport fish harvest on steelhead is uncertain--without an adequate data base it is difficult to anticipate what impact would occur if harvest levels increase from an estimated 200 steelhead in 1984 to 700 in 1995. Although the Service could increase its management of use levels and monitoring of the fishery in the four special river management areas, it is anticipated that a minor to moderate impact would occur to the refuge's steelhead population.

The effects of a sport harvest of approximately 700 rainbow trout under this alternative may be expected to cause a major long-term impact on rainbow populations. It is suspected that most rainbow populations on the refuge are extremely small localized stocks that could not withstand any sustained harvest for more than one generation. Increased management of use levels and increased monitoring in the special river management areas would reduce the potential magnitude of the impact in this alternative, but minor to moderate impacts could still occur to the refuge's rainbow trout population with increased use.

The harvest of 1,750 char from refuge populations is expected to have a negligible impact on the overall population. Although the total population level is unknown, char appear to be relatively abundant throughout the refuge and can probably sustain a higher harvest level than that projected in Alternative A.

Waterfowl

Most of the refuge's waterfowl habitat would be protected under minimal management or wilderness designation in this alternative. Key coastal waterfowl habitat located in tidal flat and lagoon areas would be protected in minimal management areas or wilderness, except for the Northeast and South Arms of Uganik and Viekoda Bays which would be under moderate management. The four special river management areas would include key tundra swan and other waterfowl nesting and feeding habitats, which may require additional protection in the future. A 33% increase in sport fishing guiding pressure projected under Alternative C over Alternative A would likely cause some disturbance to nesting waterfowl in these drainages because they receive the majority of the sport fishing pressure. Overall, impacts to waterfowl under this alternative would be negligible.

Shorebirds

Under Alternative C the majority of the refuge's interior shorebird habitat and coastal nesting, feeding and staging areas in tidal flat and lagoons would be protected in minimal management areas or as wilderness. Key shorebird habitat also would be protected in the special river management areas. Thus, although increases in sport fishing pressure along the Ayakulik/Red and Karluk Rivers could cause some disturbance to nesting and feeding shorebirds, access could be closely managed if use levels threaten to damage or destroy the river's resource values. Overall, Alternative C would have a negligible impacts on shorebirds.

Raptors

Less than 25% of the refuge's coastal bald eagle nesting and feeding habitat would be under moderate management in this alternative. Important inner bay and tidal flat areas at the heads of bays would be protected in minimal management areas and in wilderness. Key foraging habitat for non-breeding adult and subadult bald eagles located along the Ayakulik/Red and Sturgeon Rivers could be provided additional protection under the special river management designation should future increases in public use threaten to displace the bald eagles feeding in these areas. Consequently, the impacts of this alternative on the refuge's raptor population would be negligible.

Marine Birds

Some guided and unguided visits to nesting seabird colonies would likely occur in this alternative. This disturbance would cause some egg and chick loss on the colonies. However, the overall impact of this alternative on marine birds would be negligible.

Marine Mammals

Alternative C would have the same minor effect on marine mammals as Alternative A.

Deer

Alternative C would have the same effect on the deer population as Alternative A: no long-term impacts would be expected as a result of increased hunting pressure, but negligible or minor short-term impacts could occur in localized areas where hunting activity is concentrated. Areas where these impacts would be expected include Uganik Island, Viekoda Bay, Terror Bay, and the Spiridon Peninsula.

Deer hunting could have a positive benefit for deer habitat in localized areas. If the deer population were ever to increase to the point it could overbrowse an area, deer hunting would relieve overbrowsing by excessive deer.

Brown Bear

As in Alternatives A and B, Alternative C would result in increased defense of life and property (DLP) mortality and displacement from key feeding areas. While the effects of this alternative on brown bear would be similar to those described in Alternative B, there would be notable exceptions. Classifying Deadman, Uyak, Zachar, Spiridon, East Arm of Uganik and Terror bays, Uganik Island and the Spiridon Peninsula as minimal management areas rather than moderate management areas, and designating the four special river management areas would: (1) prohibit long-term human habitation (i.e., commercial operators) in areas with historically high bear densities; and (2) recognize the high values of key riverine habitat components to brown bear and other wildlife.

Reducing the level and intensity of human use on the Spiridon Peninsula and Uganik Island in addition to estuarine habitats would result in short-term transient use. Transient short-term camps related to sport fishing or deer hunting would be less likely to habituate bears and thus would lessen the potential for human/bear encounters.

The special river management area designation would permit the Service to control human use levels on identified key river systems when such use causes significant disturbance to bears during feeding periods. The most important feeding habitats for brown bear in southwest Kodiak Island, including sites on the Sturgeon River and Dog Salmon Creek, and tributaries of Red, Frazer and Karluk Lakes, would be within these special river management areas.

With lower DLP mortality and less displacement, Alternative C would have a lower potential for impacting the refuge's brown bear population than Alternative A. Overall, this scenario is expected to result in short-term negligible to minor impacts on brown bear.

Water Quality/Quantity

The effects of this scenario on water quality are expected to be essentially the same as discussed for Alternative A. With increased management of people in the special river management areas, the impacts are expected to remain at the minor level, but streambank erosion should be somewhat less than Alternative A.

Water quantity will not be affected in this alternative.

Socioeconomic Effects of Alternative C

Population

The Alternative C scenario would have the same negligible effect on the populations of the city of Kodiak and other villages as Alternative A. Total recreational use in 1995 would be about slightly greater in Alternative C, which would increase the number of people temporarily staying in the city of Kodiak. The increase in refuge recreational use, however, would not significantly affect the permanent population of any of the local communities.

Economy

The economic effect of increased public use in the Alternative C scenario would be slightly greater than Alternative A--minor, long-term positive benefits for the local economy. In the scenario the number of guided fishermen would increase by 33% in 1995, and the number of outfitted clients would decrease by 12% compared to Alternative A. As a result the number of jobs for sport fishing guides and the revenues derived from this use would increase, while the number of opportunities for more outfitters and the total revenues derived from outfitted clients would decline:

- Sport fish guides would collect an estimated $2.4 million from 2,400 clients in 1995, a 33% increase over Alternative A.[a]
- Big game hunters would receive an estimated $300,000 from 100 deer hunters, the same as Alternative A.
- Outfitters would collect an estimated $1.75 million from 1,400 clients in 1995, a decline of 22% compared to Alternative A.

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[a] See the general public use assumptions in the beginning of this chapter for the assumptions used in calculating these values.

Thus, under this scenario commercial guides and outfitters would receive an estimated $4.45 million in revenues (excluding revenues derived from bear hunting) from increased recreational use--about the same as the Alternative A scenario. Thus, the economic impact of the Alternative C scenario on commercial guides and outfitters would not vary significantly from Alternative A.

The overall increase in recreational use would provide slightly more seasonal economic benefits and jobs for recreation support businesses, such as air taxi operators and transporters, than Alternative A, primarily in the city of Kodiak. Tax revenues for the city of Kodiak also would slightly increase. Thus the alternative would have a minor impact on the city of Kodiak's economy. The other villages on the island would experience the same effects described in Alternative A: the village economies could experience some additional benefits and land management costs from increased recreational use, but the economic impact overall on the local villages would be minor.

Subsistence/Section 810(a) Evaluation and Finding

The Alternative C scenario would have about the same potential to adversely affect subsistence harvests as the Alternative A scenario. The alternative would not affect the harvest of marine resources outside of the refuge. Although more hunters and fishermen would use the refuge, the impact on habitats of important subsistence species would be negligible. With about the same number of deer hunters in both scenarios, local residents should be able to continue to harvest sufficient deer to satisfy their subsistence needs. Local residents also should be able to continue to harvest the salmon they need. Most local residents fish for salmon in salt water, outside of the refuge. Furthermore, most of the increases in sport fishing are expected to take place on rivers that are not heavily used for subsistence purposes. On the Karluk River chinook salmon and steelhead populations may become more scarce in the upper stretches due to increased sport fishing, but these fish are not used as extensively for subsistence purposes as other salmon. Competition between sport fishermen and local residents could increase for limited campsites and access points on the Karluk River. The Koniag Regional Corporation, however, is expected to continue to manage the river to ensure that subsistence activities are maintained. The Service would work with ADF&G, the state Fisheries Board, and the Native corporations to ensure that salmon harvests are maintained on the rivers in the refuge.

This alternative, like Alternative A, would not affect the subsistence needs of local residents. Subsistence activities would continue to be an important part of many local residents' lives.

Under Alternative C there would be fewer hunters and about 600 additional sport fishermen than in Alternative A. Local residents' concerns about maintaining subsistence harvests probably would increase slightly with the increased number of refuge users. Trespass on Native lands would be about the same as Alternative A. Overall, this alternative would probably generate about the same level of concern among local residents as Alternative A.

Availability of Other Lands - As stated in the Section 810(a) evaluation of the Alternative A scenario, there may be other lands available for the uses considered, but lands outside of the refuge are not considered because they are beyond the scope of this plan. Most of the other available lands on Kodiak Island are either patented or Native lands not managed by the Service--the availability of these lands for public use depends on the actions of the landowners.

Other Alternatives - The Alternative C scenario provides for about the same level of recreational use as Alternative A--sport fishing would increase in this alternative, while deer hunting would slightly decrease. Alternative B would provide additional opportunities for public use. Alternative D would provide for smaller increases in public use than Alternative C. None of the alternatives are expected to adversely affect subsistence harvests on the refuge. All of the alternatives provide for increased public use, which would increase local residents concerns about maintaining subsistence harvests.

Findings - The increase in public use in the Alternative C scenario would mean that more fishermen would harvest salmon in the refuge than in Alternative A; deer harvests would be about the same. Local residents depend primarily on marine resources which would not be affected by actions on the refuge. Although local residents may perceive increased competition in their subsistence activities on the refuge, salmon and deer would be available in sufficient quantities in this alternative for local residents to satisfy their subsistence needs. Thus, the Service concludes that Alternative C would not result in a significant restriction of subsistence use.

Recreation

In the Alternative C scenario 600 more guided sport fishermen are projected than in Alternative A in 1995, and 200 fewer outfitted clients; total public use levels would be about the same. The effects of these user levels would be similar to those described for the Alternative A scenario: potential user conflicts and perceived overcrowding could occur, primarily on popular sport fishing streams and deer hunting areas on the northwest coast.

In this alternative long-term outfitter and guide camps would generally not be located at the heads of bays. Consequently, the general public would not have to compete with these groups for limited access and camp sites, and would have freer access to the bay areas than would be the case in Alternative B.

Alternative C has about the same potential for bear-human encounters as Alternative A. There is consequently about the same potential for maulings and loss of life in both alternatives. In spite of the Service's efforts to prevent these incidents, there eventually would be maulings or deaths of people in the refuge.

Hunting - The effect of the Alternative C scenario on brown bear hunting would be about the same as Alternative A. With the same level of guided bear hunting and minor increases in resident bear hunting, hunters are expected to continue to be able to harvest large bears, including trophy-sized bears.

Under this scenario the number of unguided and guided deer hunters would be the same as in the Alternative A scenario, and the number of outfitted visitors (most of whom are deer hunters) would decline by 200 individuals. Deer hunters should continue to be able to find deer, given the expanding population. With fewer outfitted groups in this alternative, and with increased management of outfitted groups (such as encouraging groups to go to less crowded areas) competition for transportation, limited campsites and access points at popular deer hunting areas in the northwest portion of the refuge would be reduced compared to Alternative A. The potential for outfitted clients displacing unguided clients in the competition for limited campsites in popular hunting areas (e.g., Viekoda Bay, Spiridon Bay and Peninsula, Uganik Bay and Lake, and Uyak Bay) also would be reduced.

Sport Fishing - In the Alternative C scenario there would be 600 more guided sport fishermen in 1995 than in Alternative A; unguided use levels would be the same. With the increased fishing pressure there is the potential for the refuge's chinook, rainbow trout, and steelhead populations to be adversely affected, as noted in the biological assessment. The state Fisheries Board would be expected to take action to reduce harvests of these species if necessary.

Sport fishing at O'Malley Creek.

About 2,200 fishermen would fish on the rivers not designated as special river management areas in this alternative, compared to about 2,000 in Alternative A. This change should not result in major changes. With fishermen staying relatively short periods of time at one location and fishing pressure spread out over several drainages, overall there should only be minor user conflicts. Fishermen would continue to be able to catch salmon in a primitive setting in these drainages.

The Alternative C scenario projects about 5,000 fishermen using the refuge's four most popular drainages in Alternative C, versus about 4,600 in Alternative A. With 400 more guided fishermen in Alternative C, the potential for overcrowding, competition for limited campsites, access points and desirable fishing spots would all slightly increase, particularly on the Ayakulik/Red River and Uganik Lake. However, with the designation of the four special river management areas it is anticipated that the Service would attempt to more evenly distribute sport fishing use over both the season of use and available fishing streams to both protect fish populations and maintain the quality of the recreational experience. For example, the number of guided sport fishermen permitted may increase in some parts of the special river areas and decrease in other areas. Fewer fishermen seeking a pristine wilderness fishing experience would be displaced in this scenario than in Alternative A.

Nonconsumptive Uses - The Alternative C scenario would not affect the number of nonconsumptive users visiting the refuge: the relatively small number of visitors that come to the refuge just to view wildlife would continue to be able to see bears and other wildlife. Nonconsumptive users would encounter about the same level of competition with fishermen to find desirable campsites or reserve cabins as in Alternative A.

Cultural Resources

This alternative would have the potential for slightly more impacts to cultural resources than Alternative A, given the increases in public use projected in the scenario. The magnitude of the impacts would be less than in Alternative B because new cabins and campsites would not be provided, and because fewer areas would be available for guides and outfitters to use temporary support facilities--fewer users would concentrate in areas of high archaeological site density in Alternative C than in Alternative A. Overall, the alternative would have the potential for moderate impacts to cultural resources, with severe localized damage.

Wilderness Values

The effect of Alternative C on the refuge's wilderness values is not expected to vary significantly from Alternative A. With about the same levels of people and developments on the major lakes, drainages and coastal areas in this scenario as in Alternative A, the potential for crowding, littering, or other signs of people would be similar.

Wilderness Designation Effects of Alternative C

Under Alternative C the Service would propose the same areas for wilderness designation as in Alternative B. Thus, the effects of wilderness designation would be the same as described for Alternative B: wilderness designation would provide permanent long-term Congressional protection to fish and wildlife habitats in the refuge interior and would add a unique area to the National Wilderness Preservation System.

Effects on Fish and Wildlife Management

Wilderness designation in Alternative C would have the same effects on the management of fish and wildlife as Alternative B. Most management practices of the Service would not be affected. In the designated wilderness area the Service's management flexibility would be somewhat more limited than in the rest of the refuge. The Service would emphasize the "minimal tool" concept in managing fish and wildlife, which would preclude some actions. Management objectives generally could be achieved using other techniques or using temporary facilities.

Effects on Public Uses and Access

Wilderness designation would have the same effects as Alternative B: sport hunting or fishing, subsistence uses, or access into the refuge would not be affected by the action. Wilderness designation could eventually increase public use of that portion of the refuge.

Effects on Commercial Uses and Permanent Facilities

Wilderness designation in Alternative C would have the same effect on commercial uses and permanent facilities as Alternative B: potential permanent facilities and commercial uses, except for existing uses, would be precluded in the refuge.

Summary of the Effects of Alternative C

Under the Alternative C scenario public use would significantly increase over the 1984 level. Commercial harvest and escapement levels for refuge-based stocks would generally support the overall goals established for natural stocks in the Kodiak Salmon Management Area. Negligible impacts would be expected to the age structure and recruitment for pink, chum, sockeye and chinook salmon from commercial fishing. With key habitat areas in the special river management areas, the Service would be better able to control use levels, thus reducing the magnitude of impact compared to the previous alternatives: the expected increase in sport fishing in Alternative C could have minor to moderate impacts on the refuge's chinook, steelhead and rainbow populations. Negligible impacts would be expected to waterfowl, shorebird and bald eagle populations with key habitats protected in coastal minimal management areas north of Uyak Bay and in the special river management areas in the southwestern portion of the refuge. Impacts to brown bear are expected to range from negligible to minor, with key habitats at the heads of six bays, the Spiridon Peninsula and Uganik Island included as minimal management areas and key feeding habitats along the four major rivers included as special river management areas. Impacts from development and use of lands adjacent to or within the refuge boundary would likely increase the magnitude of all the above potential impacts, as noted in the summary of impacts in Alternative A.

The socioeconomic effects of Alternative C generally would be minor. Some minor economic benefits would be expected to the city of Kodiak due to recreation-related business. Subsistence opportunities would be maintained, although projected increases in public use would heighten concerns among local residents regarding increased competition. Compared to Alternative A, some improvement in visitor satisfaction would be expected with increased management of use levels on the four major river systems. The potential for bear maulings and loss of life would be about the same as Alternative A. Wilderness values would be better protected in these drainages. Some degradation of cultural resources would be expected with higher use levels, with the possibility of severe localized impacts.

The wilderness proposal in Alternative C, if adopted, would provide long-term Congressional protection to Kodiak Refuge wilderness values and fish and wildlife habitats. The designation would add a unique area to the National Wilderness Preservation System. Recreational and subsistence hunting and fishing, and existing commercial uses would not be affected by the action. The designation would preclude certain commercial uses and permanent facilities, and could limit management flexibility. Most management practices, however, would not be affected by the action.

ALTERNATIVE D

Scenario

In the Alternative D scenario the Service would increase the protection it provides to the refuge's fish and wildlife resources by limiting the increase in public use and restoring important habitat through removal of existing structures on the coastline. Increases in both guided and unguided use levels would be lower than in the Alternative A scenario. Fewer sport fish guides and outfitters would be permitted to operate in the refuge. No new outfitter tent frames would be permitted. Existing permitted guide cabins and tent frames would continue to operate through 1995 in the refuge. The increase in unguided use would be limited by regulating the number of marine transporters or instituting a permit system for unguided visitors. Both the increases in unguided deer hunters and sport fishing on the Ayakulik River would be limited. In addition, the Service would remove four public use cabins in the southwestern part of the refuge. All of these actions would be taken to reduce the potential for bear/human conflicts, minimize the potential for impacts to other fish and wildlife resources (e.g., steelhead trout), and maintain the present high quality recreation opportunities and wilderness character of Kodiak Refuge.

Under this scenario all refuge lands remaining in federal ownership would be designated as wilderness. Existing commercial permanent and temporary support structures would continue to be permitted. New commercial operators would be based out of tents that would be removed after the season of use.

Overall, 14,200 people would be estimated to use Kodiak Refuge by 1995 in the Alternative D scenario (Table 22). This represents a 15% reduction in use relative to the Alternative A scenario, although it still would be about twice the number of visitors using the refuge in 1984. Unguided users, primarily sport fishermen and deer hunters, would continue to be the primary group using the refuge, accounting for 84% of overall use. Use levels would be projected as follows in 1995:

- The number of big game guides and their clients would remain at the same levels as in the previous scenarios.

- Ten outfitters would be permitted to operate in the refuge, a 50% decrease from the level in Alternative A. About 800 clients would be outfitted. The outfitted groups would only use tents in this scenario, and would stay up to 7 days at one location.

- Twelve sport fishing guides would be permitted to operate in the refuge, about the same number that were permitted in 1984. The guides would take 1,200 clients on the refuge, a 33% decrease in the levels estimated in the Alternative A scenario. One guided group would be permitted to stay overnight on each of the refuge's 12 drainages. Guided groups would stay up to 7 days at one location.

- The Service would take several steps that would affect unguided use in this scenario. Four public use cabins would be removed to reduce use in the southwestern part of the refuge and maintain in an undisturbed state the high concentrations of bears that occur there. It is estimated that about 300 fewer people would come to the refuge as a result. The projected increase in unguided deer hunting on the refuge would be reduced by 500 hunters again to reduce the potential for bear conflicts. Finally, the increase in unguided sport fishing on the Ayakulik River would be limited to 700 users--300 sport fishermen less than allowed in the other scenarios, because of the potential for bear conflicts, potential safety problems of aircraft landing and taking off on the river, the potential for damage to other resources, and to maintain the special qualities of this river corridor (e.g., a wilderness experience).

- Sport fishing pressure on the refuge's drainages would decrease in the Alternative D scenario, relative to the Alternative A scenario, because of the fewer number of guided sport fishermen. Fishing pressure would also be reduced on the Ayakulik River, relative to the Alternative A scenario, because of the limits placed on guided and unguided use.

Biological Effects of Alternative D

Fish

The Alternative D scenario would result in the same impacts for the refuge's fish populations as Alternative C. Most management and research activities on the refuge, including the installation of new fish weirs, are expected to have a negligible impact on habitat values. If artificial fertilization of Karluk Lake occurs, however, there could be major impacts to the survival of juvenile sockeye while in fresh water. This could lead to reduced smolt size and possibly decreased marine survival and total recruitment (see the fish assessment in Alternative A).

The level of commercial fishing and resulting impacts on the refuge's salmon stocks would be the same as in Alternative B: given favorable conditions in both the freshwater and marine environments, it is expected that commercial fishing would have a negligible impact on the age structure or recruitment potential for both odd and even year pinks, chum, sockeye and chinook salmon, and a minor impact on the refuge's coho population.

Sport fish harvest of refuge-based stocks is expected to decrease under Alternative D to levels below those described in Alternative A. A sport fish harvest of approximately 6,500 coho from refuge stocks is expected under this alternative. This is expected to have a minor long-term impact on the refuge's coho stock provided the commercial harvest management takes into account the sport harvest.

Sport fish harvest estimates for chinook on the refuge from guided and unguided visits is projected to result in a combined harvest of approximately 6,500 fish. The in-river harvest and commercial offshore harvest combined is estimated at 8,400 fish. If left unmanaged, and if commercial interception increases, this could result in a major long-term impact. However, with increased control of access and use levels and increased monitoring in the special river management areas it is expected that sport fishing would have a minor to moderate impact on the refuge's chinook populations.

In this scenario it is projected that 540 steelhead and 540 rainbow trout would be harvested by sport fishermen. The effects of these harvests are difficult to estimate due to the lack of baseline data. It is anticipated that with increased management in the special river management areas the impacts from sport fishing on these species would be limited to minor to moderate impacts.

The harvest of 1,350 char from refuge populations is expected to have a negligible impact on the overall population. Although the total population level is unknown, char appear to be relatively abundant throughout the refuge and can probably sustain a higher harvest level than that projected in this alternative.

Waterfowl

The majority of the refuge's waterfowl habitat is protected under minimal management or wilderness designation. Projected levels of use in the Alternative D scenario are the lowest of the four scenarios (although about twice that of 1984 levels). Thus, the impact of this scenario on waterfowl would be negligible, the same as Alternative C.

Shorebirds

Anticipated actions in Alternative D are expected to have a negligible impact on nesting and migratory shorebirds.

Raptors

Less than 20% of the coastal bald eagle nesting habitat would be under moderate management in this alternative. The majority of the other raptor habitat would be protected in minimal management areas or as wilderness. Thus, the impact of this alternative on raptors would be negligible, the same as Alternative C.

Marine Birds

With the reduced amount of moderate management on coastal areas and reduced projected levels of public use, the impact of this alternative on marine birds would be negligible, same as Alternative C.

Marine Mammals

Alternative D would have the same minor effect on marine mammals as Alternative A.

Deer

Alternative D would result in fewer deer hunters than Alternative A, but the effect would be the same on the deer population: no long-term impacts would be expected, but negligible or minor short-term impacts could occur in localized areas where hunting activity is concentrated. Areas where these impacts could occur include Uganik Island, Viekoda Bay, Terror Bay, and the Spiridon Peninsula.

Brown Bear

The Alternative D scenario would result in less public use than the other alternatives and therefore would have a lower potential for adversely affecting brown bear. The effects of the actions in Alternative D would be similar to those identified for Alternative C. For the special river management areas the effects on bear would be essentially the same in both alternatives. Increased acreage under wilderness management and removal of commercial support facilities in Alternative D provides an opportunity to reduce impacts to bear, especially for coastal areas in the northwestern portion of the refuge. This would be especially true if some permanent facilities were removed and inholdings were acquired by the Service. The potential for reduced human activity in coastal habitat from Zachar Bay to Viekoda Bay could result in greater use of the coastline by brown bears.

Some actions of Alternative D, such as removal of four public use cabins and limiting unguided use in the southwest part of the refuge, would reduce human activities and therefore lessen the potential for impacts to bears. Removing the O'Malley and Red Lake cabins has the highest potential for reducing disturbance in key feeding habitat.

In summary, a few segments of the bear population could receive limited, beneficial effects from Alternative D management. The overall impact on brown bears would be negligible, with minor impacts in a few localized areas.

Water Quality/Quantity

The effect of the Alternative D scenario on water quality and quantity would be essentially the same as described for Alternative C: a minor impact on water quality, primarily due to increased shoreline erosion, and no effect on water quantity.

Socioeconomic Effects of Alternative D

Population

The Alternative D scenario would have the same negligible effect on the populations of the local communities as Alternative A. There would be about 2,500 fewer visitors in 1995 in this scenario than in Alternative A (although the use level would still about double compared to 1984). Fewer visitors consequently would temporarily stay in the city of Kodiak during the fishing and hunting seasons. This change in use would not significantly affect the permanent population of any of the local communities.

Economy

The economic effect of decreased public use in the Alternative D scenario would be slightly less than Alternative A--minor, long-term positive benefits would still accrue to the local economy. In the scenario both the number of guided fishermen and the number of outfitted clients would decrease by 50% in 1995 compared to Alternative A. Consequently, the number of jobs for commercial operators and the total revenues derived from guided and outfitted clients would decline:

- Sport fish guides would collect an estimated $1.2 million from 1,200 clients in 1995, a 33% decrease from Alternative A.[a]

- Big game guides would receive an estimated $300,000 from 100 deer hunters, the same as Alternative A.

- Outfitters would collect an estimated $1 million from 800 clients in 1995, a decline of 55% compared to Alternative A.

Thus, under this scenario commercial guides and outfitters would receive an estimated $2.5 million in revenues (excluding revenues derived from bear hunting) from increased recreational use--a 43% decrease from the Alternative A scenario. Although the total revenues would decline because there would be fewer guides and outfitters permitted to use the refuge, the economic impact of this decrease in revenues on individual permitted operators would not vary significantly from Alternative A--the incomes of the operators using the refuge would be greater in 1995 than in 1984 due to the increase in numbers of clients per operator.

In addition to the decrease in guided and outfitted clients, the number of unguided users would decrease by about 15% in this scenario. The overall decrease in recreational use would result in slightly fewer seasonal economic benefits and jobs for recreation support businesses than Alternative A, primarily in the city of Kodiak. With fewer people visiting the refuge air taxi operators and transporters would take in lower revenues. Tax revenues for the city of Kodiak also would slightly decline. Thus the alternative would have a minor impact on the city of Kodiak's economy. Although the other villages on the island would have fewer opportunities to realize revenues with a reduction in refuge users, relative to Alternative A, they also probably would have lower land management costs. Overall, the reduction in refuge visitors is expected to have a negligible effect on the village economies.

Subsistence/Section 810(a) Evaluation and Finding

Alternative D would have about the same potential to adversely affect subsistence harvests as the Alternative A scenario. The alternative would not affect the harvest of marine resources outside of the refuge. Although more hunters and fishermen would use the refuge, the impact on habitats of important subsistence species would be negligible. The reduction in sport deer hunters would not affect local residents opportunities to harvest deer--deer should be available in sufficient quantities to satisfy the needs of local residents. Local residents also should be able to continue to harvest the salmon they need. Most salmon are harvested by local residents in salt water, outside of the refuge. With fewer sport fishermen on the refuge, competition between sport fishermen and local residents for limited campsites and access points on the Karluk River would decline relative to Alternative A.

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[a] See the general public use assumptions in the beginning of this chapter for the assumptions used in calculating these values.

This alternative, like Alternative A, would not affect the subsistence needs of local residents. Subsistence activities would continue to be an important part of many local residents' lives.

Under Alternative D there would be 2,500 fewer visitors in 1995 than in Alternative A. With fewer sport hunters and fishermen local residents' concerns about maintaining subsistence harvests probably would decrease slightly (although there would be more concerns compared to use levels in 1984). Trespass on Native lands would decline compared to Alternative A.

Availability of Other Lands - As stated in the Section 810(a) evaluation of the Alternative A scenario, there may be other lands available for the uses considered, but lands outside of the refuge are not considered because they are beyond the scope of this plan. Most of the other available lands on Kodiak Island have limited access and are either patented or Native lands not managed by the Service--the availability of these lands for public use depends on the actions of the landowners.

Other Alternatives - The Alternative D scenario provides for the smallest increases in public use of the four alternatives--fewer sport fishermen and deer hunters would use the refuge in this alternative. The other three alternatives provide for varying increases in opportunities for public use. None of the alternatives are expected to adversely affect subsistence harvests on the refuge. All of the alternatives provide for increased public use, which would increase local residents concerns about maintaining subsistence harvests.

Findings - As noted in the previous assessments, local residents primarily harvest marine resources outside of the refuge for subsistence purposes. The management actions in Alternative D would not affect these harvests. Within the refuge deer and salmon should be available in sufficient quantities for local residents to satisfy their subsistence needs. The reduction in numbers of sport hunters and fishermen in this scenario should slightly reduce the competition local residents perceive in their subsistence activities, compared to Alternative A. Thus, the Service concludes that Alternative D would not result in a significant restriction of subsistence use.

Recreation

In the Alternative D scenario 600 fewer guided sport fishermen, 800 fewer outfitted clients, and 1,200 fewer unguided visitors are projected in 1995 than in Alternative A; total public use levels would decline by about 15%. With lower use levels the potential for user conflicts and perceived overcrowding on popular sport fishing streams and deer hunting areas in the refuge would be reduced in this scenario compared to the Alternative A scenario (although compared to 1984 levels the potential for conflicts and overcrowding would increase).

With fewer users visiting the refuge, Alternative D has a slightly lower potential for bear-human encounters than Alternative A. Consequently, the potential for maulings and loss of life would be lower in this alternative. There eventually would be maulings or deaths of people in the refuge, in spite of the Service's efforts to prevent these incidents.

Hunting - The effect of the Alternative D scenario on brown bear hunting would be about the same as Alternative A. With the same level of guided bear hunting and minor increases in resident bear hunting, hunters are expected to continue to be able to harvest large bears, including trophy-sized bears. Greater use of coastal habitats by bears in this scenario could improve the success of sport hunters. The removal of four public use cabins in the southwest part of the refuge would not affect the number of bear hunters coming to the refuge.

The reduction in deer hunters in this alternative would not affect the opportunity of hunters to find deer relative to Alternative A--the probability of hunters harvesting deer would be about the same in both scenarios provided there are no severe winters. The removal of the public use cabins in the southwest portion of the refuge would result in fewer deer hunters using this portion of the refuge; hunters that continue to go into the area probably would be more concerned about bear-human encounters.

With fewer unguided deer hunters and outfitted visitors (most of whom are deer hunters) and with increased management of outfitted groups (such as encouraging groups to go to less crowded areas), competition for transportation, limited campsites and access points at popular deer hunting areas in the northwest portion of the refuge would be reduced compared to Alternative A. The potential for outfitted clients displacing unguided clients in the competition for limited campsites in popular hunting areas also would be reduced.

Sport Fishing - The scenario projects about 3,800 fishermen in Alternative D, versus about 4,500 in Alternative A, with both the numbers of guided fishermen and unguided fishermen being reduced; the increase in unguided use on the Ayakulik River would be limited to 700 fishermen, 300 less than the other alternatives, as noted in the description of the scenario. The chances for fishermen to harvest large numbers of salmon would be about the same in both the Alternative A and D scenarios. With fewer fishermen and increased management in the special river management areas in this alternative, the chances for fishermen to catch chinook, steelhead and rainbow trout would improve relative to Alternative A.

About 1,600 fishermen would fish on the refuge's less popular drainages in this alternative, compared to about 1,900 in Alternative A. This change should not result in major changes in these drainages: in both scenarios fishermen would continue to be able to catch salmon in a primitive setting and generally would be satisfied with their trips. With fishermen staying relatively short periods of time at one location and fishing pressure spread out over several drainages, overall there should only be minor user conflicts.

In the Ayakulik/Red, Sturgeon, Karluk and Dog Salmon special river management areas the Service would attempt to more evenly distribute sport fishing use over the season of use to both protect fish populations and maintain the quality of the recreational experience. For example, the number of guided sport fishermen permitted may increase in some parts of the special river areas and decrease in other areas. As a result the potential for overcrowding, competition for limited campsites, access points and desirable fishing spots would be lower, particularly on the Ayakulik/Red River. Fewer fishermen seeking a pristine wilderness fishing experience would be displaced in this scenario than in Alternative A.

Most fishermen would continue to come to the refuge in spite of the removal of the four public use cabins in the southwest portion of the refuge. Fishermen that continue to use the southwest portion of the refuge would be more concerned about their health and safety without the presence of cabins.

Nonconsumptive Uses - Reducing the number of hunters and fishermen in this scenario would not significantly affect the level of nonconsumptive use. The opportunity to view bears and other wildlife would be slightly better in the Alternative D scenario compared to Alternative A. With less human activity and developments on the coastal areas, the opportunity for visitors to view bears on the coasts would improve. However, the removal of the public use cabins would affect the number of nonconsumptive users visiting the refuge. With no cabins in the southwest part of the refuge, where large concentrations of bears can be observed, some potential users would not come. People that continue to use this area would be more concerned about bear-human encounters without the presence of cabins. Nonconsumptive users would also encounter more competition than in Alternative A for desirable campsites and available cabins.

Cultural Resources

The Alternative D scenario would reduce the number of users, relative to Alternative A, limit use levels in the special river management areas, remove four public use cabins, and remove commercial facilities wherever possible on the coast. Consequently, the impact of this alternative on the refuge's cultural resources would be lower than Alternative A. (Indeed, the removal of facilities may actually reduce potential threats in some areas below present levels.) The projected increase in public use over existing levels, however, would still potentially pose a moderate impact to the refuge's cultural resources.

Wilderness Values

Alternative D would provide greater protection of the refuge's wilderness values than Alternative A. The removal of the public use cabins and other commercial support structures along the coast probably would not affect most visitors' perceptions of the refuge's wilderness values. However, with fewer people and developments on the major lakes, drainages and coastal areas in this alternative than in Alternative A, the potential for crowding, littering, or other signs of people would be lower.

Wilderness Designation Effects of Alternative D

Under Alternative D the Service would propose all of the refuge for wilderness designation. Although more of the refuge would be proposed for designation than the preceding alternatives, the effects of wilderness designation would be the same as described for Alternative B: wilderness designation would provide permanent long-term Congressional protection to fish and wildlife habitats in the refuge interior and would add a unique area to the National Wilderness Preservation System.

Effects on Fish and Wildlife Management

Wilderness designation in Alternative D would have the same effects on the management of fish and wildlife as Alternative B. Most management practices of the Service would not be affected. The Service's management flexibility would be somewhat more limited than in the other alternatives because all of the refuge would be proposed for designation. The Service would emphasize the "minimal tool" concept in managing fish and wildlife, which would preclude some actions. Management objectives generally could be achieved using other techniques or temporary facilities.

Effects on Public Uses and Access

Wilderness designation would have the same effects in Alternative D as Alternative B: sport hunting or fishing, subsistence uses, or access into the refuge would not be affected by the action. Wilderness designation could eventually increase public use of the refuge.

Effects on Commercial Uses and Permanent Facilities

Wilderness designation in Alternative D would have the same effect on commercial uses and permanent facilities as Alternative B: potential permanent facilities and commercial uses, except for existing uses, would be precluded in the refuge.

Summary of the Effects of Alternative D

Under the Alternative D scenario public use would nearly double over the 1984 level. Commercial harvest and escapement levels for refuge-based stocks would generally support the overall goals established for natural stocks in the Kodiak Salmon Management Area. Designating the four special river management areas would permit the Service to better control use levels on these systems, thus reducing potential impacts in key habitat areas. Negligible impacts would be expected to the age structure and recruitment for pink, chum, and sockeye salmon from commercial fishing. The increase in sport fishing could have minor to moderate long-term impacts to chinook, steelhead and rainbow trout populations. Negligible impacts would be expected to waterfowl populations with key coastal waterfowl habitats protected in minimal management areas north of Uyak Bay and in the special river management areas in the southwestern portion of the refuge. Negligible impacts also would be expected to bald eagles in these areas. Impacts to brown bear are expected to be negligible: including key habitats at the heads of six bays, the Spiridon Peninsula and Uganik Island as minimal management areas and including key feeding habitats along the four major rivers as special river management areas would significantly reduce the potential for impacts, relative to Alternative A. Fewer public use cabins would result in fewer human/bear encounters and lowered DLP mortality. Impacts from development and use of lands adjacent to or within the refuge boundary, however, would likely increase the magnitude of all the above potential impacts, as noted in the Alternative A summary of impacts.

The socioeconomic effects of Alternative D generally would be minor. Some minor economic benefits would be expected to the city of Kodiak due to recreation-related business. Subsistence opportunities would be maintained. Compared to Alternative A, some improvement in visitor satisfaction would be expected with increased management of use levels on the four major river systems. Wilderness values also would be better protected in these drainages. With fewer visitors in this alternative the potential for bear maulings and loss of life would be slightly less than Alternative A. Some degradation of cultural resources would be expected, with the possibility of severe localized impacts.

The wilderness proposal in Alternative D, if adopted, would provide long-term Congressional protection to Kodiak Refuge wilderness values and fish and wildlife habitats. The designation would add a unique area to the National Wilderness Preservation System. Recreational and subsistence hunting and fishing, and existing commercial uses would not be affected by the action. The designation would preclude certain commercial uses and permanent facilities, and could limit management flexibility. Most management practices, however, would not be affected by the action.

SUMMARY OF THE SECTION 810(a) EVALUATIONS AND FINDINGS

Section 810(a) of the Alaska National Interest Lands Conservation Act (ANILCA) states:

> In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands under any provision of law authorizing such actions, the head of the Federal agency having primary jurisdiction over such lands or his designee shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes.

The management alternatives in the Kodiak Refuge Comprehensive Conservation Plan/EIS do not withdraw, reserve, lease or permit any use of the public lands, as defined by Section 102(3) of ANILCA, within the refuge. However, they do recommend various land uses be allowed on the refuge. It is for this reason that Section 810 evaluations and findings are included in this document.

The Kodiak Refuge Comprehensive Conservation Plan/EIS is a general land use plan, and makes only recommendations for land uses on the refuge. Other Service actions on the refuge, including development of the more specific refuge management plans, and issuance of special use permits, will directly affect specific land uses on the refuge. The Service will make additional Section 810 evaluations for all other activities that affect land uses on Kodiak Refuge.

As one of the four major purposes of Kodiak Refuge, under Section 303(6)(B) of ANILCA, subsistence considerations have been addressed throughout the plan. Chapter III of the plan identifies subsistence concerns raised by local residents. Chapter IV notes important subsistence species, describes subsistence use patterns, and identifies areas where local residents harvest resources in the refuge. All of the management alternatives included in this plan share a common management direction on subsistence. All of the alternatives would provide for continued subsistence use of refuge resources. In its Section 810(a) evaluations of the four alternatives, included in this chapter, the Service determined that none of the alternatives would significantly restrict subsistence use.

The preferred alternative, Alternative C, provides broad directions for uses of the 1,865,000 acres (755,000 ha) of federal and Native lands within the refuge boundary. A complete description of the actions recommended in the preferred alternative is found in Chapter VI. The primary purpose of the preferred alternative is to protect fish and wildlife habitat and to maintain the harvest of fish and wildlife. Actions recommended in the alternative for the public lands include designating the Ayakulik/Red, Dog Salmon, Sturgeon and Karluk rivers as special river management areas, limiting the duration recreational users can camp at one location, prohibiting the development of new permanent commercial support facilities in the refuge interior, and proposing about 1,074,000 acres (435,000 ha) for wilderness designation.

The Service determined in its Section 810(a) evaluation that the preferred alternative would have a negligible impact on subsistence use in Kodiak Refuge, although concerns over increased recreational use may be expressed. The harvest of marine resources, the most important resources used by local residents for subsistence purposes, occurs outside of the refuge and would not be affected by actions described in Alternative C. Increased numbers of sport hunters and fishermen in this alternative would take more deer and salmon in the refuge than in 1984, but sufficient deer and salmon should be available for local residents to satisfy their needs. The Service would work with the Native corporations, ADF&G and the state Boards of Fisheries and Game to ensure that subsistence activities are not adversely affected by actions taken in this alternative.

The Service developed and evaluated three other management alternatives for Kodiak Refuge. The primary difference in the alternatives is differences in the levels of public use that would occur. Two alternatives would provide for larger increases in public use than Alternative C, while one alternative would provide for smaller increases in public use. Although all of the alternatives may increase local residents' concerns about maintaining their subsistence harvests, none of the alternatives would significantly restrict subsistence use in the refuge.

MITIGATION

Adverse impacts resulting from implementing the Kodiak Refuge Comprehensive Conservation Plan will be mitigated whenever and wherever possible, relative to the goals and objectives of the plan. As noted in the common management directions, ADF&G will regulate fish and wildlife harvests in the refuge. Changes in the hunting and fishing regulations and improved inventory procedures should mitigate most adverse effects associated with increased numbers of hunters and anglers visiting the refuge. The Service will promulgate regulations, develop stipulations, and issue permits to mitigate other impacts. These regulations, stipulations and permits will mitigate impacts by: avoiding the impact altogether; minimizing the impact by limiting the degree or magnitude of the action; rehabilitating or restoring the affected environment; or compensating for the impact by replacing or providing substitute resources or environments. Mitigation may consist of standard stipulations imposed on common refuge activities, or may be attached to special use permits. Site-specific, project-specific mitigation identified through detailed "step-down" management plans or the NEPA process would also entail stipulations attached to permits. The degree, type, and extent of mitigation undertaken will depend on site-specific conditions at the time of the impact and the management goals and objectives of the actions being implemented.

Wilderness designation in Alternatives B, C, and D would preclude the need for mitigation of most potential commercial uses. If wilderness designation increased public use in the refuge, the Service may have to mitigate potential adverse impacts to protect refuge resources. Steps that may be required include dispersing information, altering physical features, issuing back-country permits, instituting eligibility requirements, limiting use either spatially or temporally, or restricting activities.

SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY

In Alternatives A through D, including the Service's preferred alternative, the primary short-term use of the refuge would be for recreational and subsistence purposes. Projected increases in the number of people visiting and using the refuge over the planning period (mainly for deer hunting and sport fishing) could result in the displacement of some brown bears and overharvesting of chinook, steelhead or rainbow trout fish stocks. Alternatives A and B could affect the long-term productivity of chinook salmon, steelhead and rainbow trout, and certain segments of brown bear populations along major drainages and in coastal areas north of Uyak Bay. In Alternatives C and D, long-term productivity for these species would not be affected.

In Alternatives B, C, and D wilderness designation would provide long-term protection to refuge habitats, and would thus help maintain long-term productivity of the refuge's populations. Most existing uses of the refuge (e.g., hunting, fishing, wildlife observation) would not be affected by the designation. Several potential short-term uses, however, would be precluded, including most commercial uses (e.g., hydroelectric development, roads, logging, oil and gas development). No new permanent structures (except for administrative purposes) would be permitted in the wilderness. Motorized equipment would be permitted only if it is a minimum tool for administrative purposes.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The projected increase of public use in all of the alternatives could result in the loss of cultural resources from site degradation, vandalism, and unauthorized artifact collection. This would probably be most pronounced in Alternatives A and B, where management strategies for controlling excessive human use would be least effective. This potential loss of prehistoric features will be minimized through the Service's continuing efforts to identify and protect cultural resources in areas of high human use.

Wilderness designation would result in no irreversible and irretrievable commitments of resources. Congress establishes these conservation units, and can revoke the designation as well.

VIII. EVALUATION OF THE ALTERNATIVES

VIII. EVALUATION OF THE ALTERNATIVES

Selecting a preferred management alternative involves determining how well each alternative satisfies criteria or standards set forth by the decisionmaker. This section evaluates each of the four alternatives for Kodiak Refuge against two evaluation criteria, and proposes one of the alternatives as the plan for managing the refuge.

EVALUATION CRITERIA

To select the preferred alternative, and minimize subjectivity, the four alternatives were judged primarily against two criteria. These criteria, in order of importance, were:

1) To what extent does the alternative satisfy the purposes of the refuge and other provisions of ANILCA?

2) To what extent does the alternative satisfy the issues and concerns of the public?

The relative costs of implementing the alternatives were also examined in the evaluation of the alternatives.

The most important criterion in evaluating the alternatives is the degree to which the alternative achieves the four purposes of the refuge, as mandated by ANILCA (see Chapter I). The biological and socioeconomic assessments indicate how well each alternative satisfies this criterion.

Tables 24 and 25 summarize in graphic form two of the major differences between the alternatives. Table 26 summarizes the potential biological impacts of each alternative, and Table 27 summarizes the socioeconomic impacts. None of the alternatives would result in major impacts to water quality/quantity or would prevent the United States from fulfilling its international treaty obligations. None of the alternatives are expected to significantly affect the availability of important subsistence fish and wildlife populations or restrict harvest opportunities. The alternatives would not affect commercial fishing or other marine resource harvests, and thus would have a negligible effect on the local communities. All of the alternatives, however, would have some adverse effects on the refuge resources and users due to the expected increase in public use. Most of these impacts would be negligible to minor.

Of all the alternatives considered, Alternative D poses the fewest risks to the refuge resources and users--compared to the other alternatives, Alternative D would best fulfill ANILCA purposes relating to conservation of fish and wildlife populations and habitats in their natural diversity.

Table 24. Relative changes in public use levels under the four alternatives.

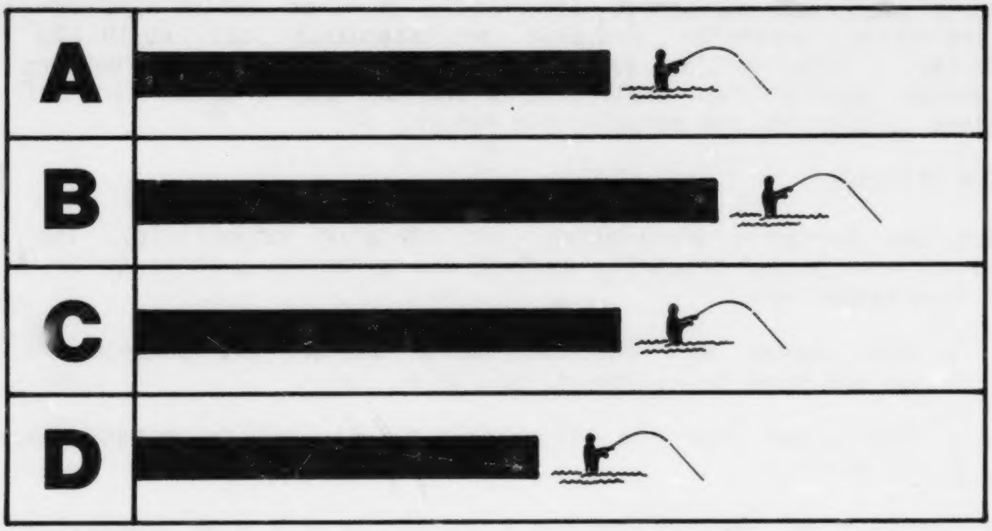


Table 25. Proportion of refuge lands proposed for wilderness designation under the four alternatives.

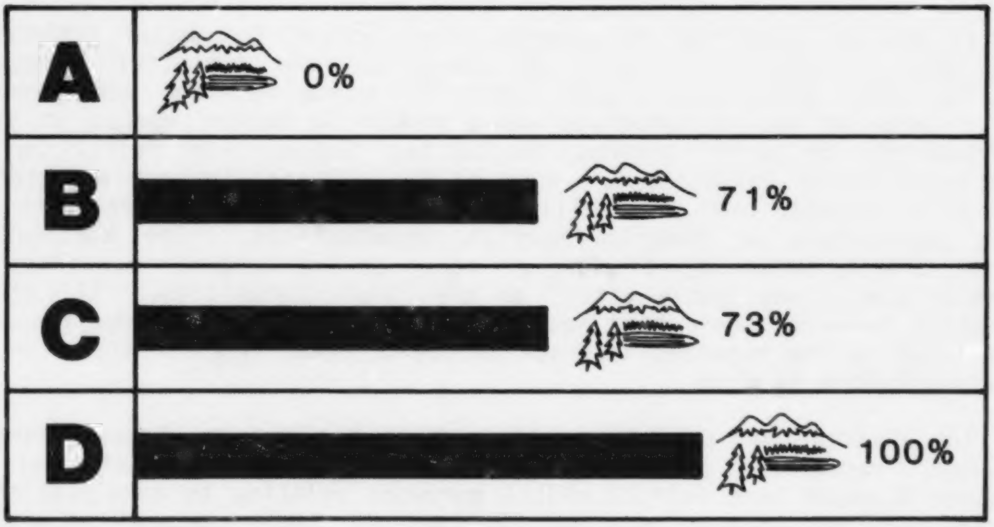


Table 26. Summary of the biological impacts resulting from the management alternatives.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Fish	Negligible effects on refuge based stocks of sockeye, chum and pink salmon; minor impacts from sport fishing on chinook and coho salmon; possible moderate long term impacts for rainbows and major impacts for steelhead due to the increase in public use	Negligible effects on refuge based stocks of sockeye, chum and pink salmon; minor impacts from sport fishing on coho salmon; major long term impacts possible for chinook, steelhead, and rainbow trout due to the increase in public use	Negligible effects on refuge based stocks of sockeye, chum and pink salmon; minor impacts from sport fishing on coho salmon; minor to major long term impacts possible for chinook, steelhead and rainbow trout due to the increase in public use	Negligible effects on refuge based stocks of sockeye, chum and pink salmon; minor impacts from sport fishing on coho salmon; minor to major long term impacts possible for chinook, steelhead and rainbow trout due to the increase in public use
Waterfowl	Negligible effects overall, but increased disturbance in coastal and riverine habitats due to the increase in public use	Minor effects, to waterfowl refuge-wide; moderate short term effects in localized areas due to the increase in public use	Negligible effects on waterfowl with key coastal and riverine habitats protected	Negligible effects on waterfowl with key coastal and riverine habitats protected
Shorebirds	Negligible effect overall; increased disturburbance of fall staging and feeding areas in inner bay regions as public use levels increase	Minor effect overall; increased disturbance of fall staging and feeding areas in inner bay regions as public use levels increase	Negligible effects overall with key fall staging and feeding areas protected	Negligible effects overall with key fall staging and feeding areas protected
Raptors	Negligible effects overall, but some increase in disturbance in nesting and feeding areas along the coastline	Minor impacts overall, with locally moderate long term effects possible on major river systems and heads of bays north of Uyak Bay	Negligible effects overall with key feeding and nesting areas protected	Negligible effects overall with key feeding and nesting areas protected
Marine Birds	Negligible effects overall; increased power boating and aircraft traffic along near-shore areas would result in some disturbance to nesting colonies	Negligible effects overall; increased power boating and aircraft traffic along near-shore areas would result in some disturbance to nesting colonies	Negligible effects overall; increased power boating and aircraft traffic along near-shore areas would result in some disturbance to nesting colonies	Negligible effects overall; increased power boating and aircraft traffic along near-shore would result in some disturbance to nesting colonies
Marine Mammals	Negligible effects	Negligible effects	Negligible effects	Negligible effects

Table 26. Summary of the biological impacts resulting from the management alternatives (continued).

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Brown Bear	Negligible effects overall, with minor to moderate impacts in coastal areas north of Uyak Bay due to the increase in deer hunting activity	Moderate impacts possible due to increased numbers of deer hunters using key bear habitats north of Uyak Bay, Spiridon Peninsula and Uganik Island	Negligible to minor effects overall with increased management of users in key habitat areas, special river management areas and coastal areas	Negligible effects overall, with elimination of public use cabins, lower number of users, and increased management of public use in the special river management areas; minor impacts in localized areas
Water Quantity/	No significant change, but increased erosion of streambanks in localized areas due to increased public use	No significant change, but increased erosion of streambanks in localized areas due to increased public use	No significant change, but increased erosion of streambanks in localized areas due to increased public use	No significant change, but increased erosion of streambanks in localized areas due to increased public use

Table 27. Summary of the socioeconomic impacts resulting from the management alternatives.

Resource/ Activity	Alternative A	Alternative B	Alternative C	Alternative D
Population	Negligible effect; seasonal increase in the population population of the city of Kodiak	Negligible effect overall; all; greatest seasonal increase in the population of the city of Kodiak	Negligible effect overall; seasonal increase in the population of the city of Kodiak	Negligible effect overall; smallest increase in the population of the city of Kodiak
Economy	Minor benefits to the city of Kodiak's economy, primarily to recreation-related businesses; negligible benefits to other local villages; guides and outfitters would substantially benefit	Minor effect overall; increased benefits to the city of Kodiak, primarily recreation-related businesses; negligible benefits to other local villages; guides and outfitters would substantially benefit	Minor benefits to the city of Kodiak's economy, primarily to recreation-related businesses; negligible benefits to other local villages; guides and outfitters would substantially benefit	Minor economic effect overall; slightly lower benefits to the city of Kodiak's economy, due to fewer refuge users; local villages would receive negligible benefits; permitted guides and outfitters would substantially benefit
Subsistence	No significant effect on important resources or the harvests of these resources	No significant effect on important resources or the harvests of these resources; increases in refuge use would heighten local residents concerns about maintaining opportunities for subsistence activities	No significant effect on important resources or the harvests of these resources	No significant effect on important resources or the harvests of these resources
Recreation	Increased competition and perceived overcrowding in popular sport fishing and hunting areas; no significant effect on bear hunters and negligible effect on nonconsumptive users	Substantial increases in user competition and perceived overcrowding in popular use areas	Negligible effect on bear hunting and non-consumptive uses; reduced user competition and perceived overcrowding in the special river management areas	The potential for user conflicts and overcrowding would decline with lower use levels and increased management in the special river management areas
Wilderness Values	Wilderness values maintained in most of the refuge; in heavy public use areas wilderness values would be diminished	Wilderness values generally maintained, but values would be diminished in more areas due to increased public use levels	Wilderness values maintained in most of the refuge; fewer areas would be adversely affected due to increased management in the special river management areas	Wilderness values maintained in most of the refuge; removal of the public use cabins and commercial support facilities, would restore wilderness values in coastal areas
Wilderness Designation	No areas proposed for designation; the Service would retain maximum flexibility for managing the refuge	Positive benefit to the National Wilderness Preservation System; loss of management flexibility in most of the refuge; increased public use could result from the designation	Positive benefit to the National Wilderness Preservation System; loss of management flexibility in most of the refuge; increased public use could result from the designation	Positive benefit to the National Wilderness Preservation System; loss of management flexibility in all of the refuge; increased public use could result from the designation
Cultural Resources	Moderate impacts due to degradation and loss of cultural resources from increased public use; severe localized impacts due to artifact hunting possible	Increased impacts due to higher use levels, with severe localized impacts possible; moderate impacts overall	Moderate impacts due to increased public use, with severe localized impacts possible	Moderate impacts overall; reduced public use and removal of public use cabins and commercial support facilities would reduce potential threats in certain areas

With more people using the refuge and more commercial support facilities in Alternatives A, B, and C, there would be a higher potential for impacts to refuge resources and users than in Alternative D. The increase in recreational use in Alternative A would increase the number of bear kills in defense of life and property, and could result in significant impacts to rainbow trout, steelhead, and cultural resources. Alternative B would provide for a higher level of use, which would both increase the magnitude of the impacts and increase the area where the impacts occur. In addition to the potential impacts noted in Alternative A, significant impacts could occur to the refuge's chinook salmon population. Increased recreational use would also increase competition between user groups for transportation, popular cabins, camping sites, and access points, and increase crowding in heavily used areas.

The level of public use in Alternative C is similar to Alternative A, so the overall magnitude of the biological impacts of the two alternatives probably would not differ significantly. However, with increased management of users in the special river management areas, smaller increases in the number of outfitted groups, and fewer commercial support facilities this alternative would have less of an adverse effect on refuge resources and users than Alternatives A or B (but more than Alternative D).

In all of the alternatives impacts from developments on Native allotments and private lands, both within and adjacent to the refuge boundary, would increase the potential for cumulative impacts to nesting bald eagles and brown bear. The presence of more development and habitation in or near the refuge would reduce available bear habitat, displace bears, and increase bear kills in defense of life and property over the impacts expected from increased recreational use. As a result, the number of bears in the refuge could eventually decline. Similarly, more people and facilities in or near the refuge could increase disturbance of nesting bald eagles, which in turn could reduce the number of eagles in the refuge.

In summary, the potential for impacts and the severity of the impacts on the fish, wildlife, and people that use Kodiak Refuge increases as one moves from Alternative D to the other alternatives--Alternative D would cause the smallest number of impacts, while Alternative B would cause the largest number of impacts over the largest area. From a refuge-wide perspective, most of the impacts that would result from the four alternatives would tend to be negligible to minor in extent; a few moderate impacts could occur in heavily used areas with good access (e.g., the refuge's northwest coast). None of the alternatives is expected to result in a population decrease that would affect the long-term viability of the refuge's fish and wildlife populations, although reduced harvest levels may be required for sport harvests of steelhead, chinook salmon, and brown bear. Increased public use would also result in the long-term loss of wilderness values and irreversible loss of valuable cultural resources in heavily used parts of the refuge. Impacts from developments on inholdings or adjacent lands could result in additional decreases in the refuge's brown bear and bald eagle populations, although the decreases would not threaten the viability of the populations. The Service would need to devote more attention to monitoring and managing recreational use levels on the refuge, and monitoring effects of developments on adjacent private lands to ensure that impacts are minimized.

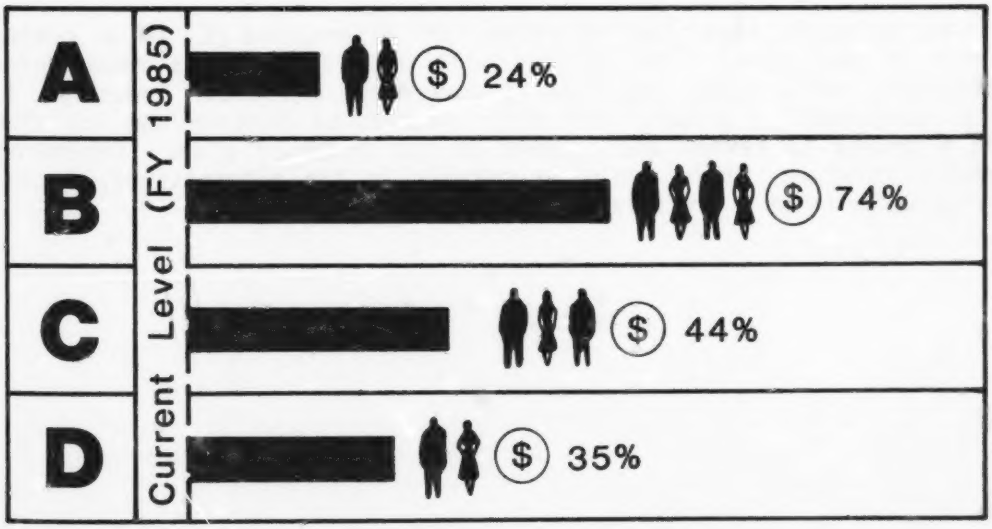
The second criterion is the degree to which the alternatives respond to or satisfy the issues and concerns raised by the state, local residents, industry, conservation groups, and other interested parties. The Service must work closely with all of these groups, minimizing conflicts, if it is to effectively manage the refuge and its resources.

The major refuge issues and concerns were identified early on in the planning process and provided the basis for the development of the management alternatives. Many groups have an interest in and would be affected by how the Service manages Kodiak Refuge. No single alternative probably would satisfy all of the concerns of these groups--each of the alternatives would satisfy the concerns of some groups and cause problems for other groups. For example, Alternative D would satisfy conservation groups desires to maximize environmental protection, but the alternative would not satisfy commercial guides or outfitters who wanted to establish support facilities for their clients in the refuge. The Service believes that although Alternative C may not satisfy all of the concerns of recreational users, adjacent landowners and other affected groups, the alternative would meet many of their needs. The comments the Service receives from the public on this draft comprehensive conservation plan/EIS will determine the validity of this assertion.

RELATIVE COSTS OF THE ALTERNATIVES

Staffing needs and management costs are another factor to consider in evaluating the alternatives. Table 28 compares the costs of the four alternatives to the current operations and maintenance budget. Alternative A, the current situation, would be the least costly of the four alternatives, both in terms of staff and funding; Alternative B would be the most expensive. Alternative C would require five more staff than the current staff and about a 44% increase in funding over the current operations and maintenance budget to manage the expected increase in public use; Alternative D would require about the same increase.

Table 28. Relative cost of implementing the four alternatives.



SELECTION OF THE PREFERRED ALTERNATIVE

The Service has selected Alternative C as its preferred alternative for managing Kodiak Refuge on the basis that it would both satisfy the purposes of the refuge, and ensure that the opportunities for high quality recreational experiences are maintained for the widest range of users. The alternative would continue most existing refuge policies, which are well accepted by most users, and would provide opportunities for additional use. With increased public use, some adverse impacts would be expected to refuge resources and users, but these would tend to be concentrated in a few areas. Under this alternative the Service would lay the groundwork for future regulation of refuge users, if that becomes necessary, in the special river management areas. The Service would also carefully monitor and regulate all uses and activities both within and adjacent to the refuge to ensure that adverse impacts to refuge resources and users are minimized.

The other alternatives were not selected because of their potential impacts on resources or user groups, because they do not adequately respond to public concerns, or because the actions are not warranted at this time. Alternative A was not selected because it would not adequately respond to the concerns of the village corporations concerning the Native conveyed lands within the refuge boundary, because it does not adequately address some of the future potential problems facing the refuge (e.g., increased public use), and because it does not propose outstanding parts of the refuge for wilderness designation. Alternative B was not selected because of the concerns regarding impacts to refuge resources and users from high use levels, because there was little or no interest identified by the Service for increasing public use levels by these amounts, and because of the high costs in both funding and staff time. Alternative D was not selected because it has not yet been demonstrated that the increases in refuge use warrants the level of action called for, because there is some question as to what steps the Service can take to rehabilitate the coastline, and because the alternative would not adequately respond to the needs of various refuge users (e.g., commercial set net fishermen, outfitters).

It must be stressed that the selection of Alternative C as a preferred alternative is tentative. The Service will not finalize its recommendation until affected local, state and federal government agencies, industry, local interests, conservation groups, and other interested parties and individuals have had a chance to review and comment on the proposed plan. Depending on the comments received, there could be changes in the alternatives, including the Service's choice of a preferred alternative.

View from Uganik Island.

APPENDICES

APPENDIX A. List of Preparers.

The planning team for the draft Kodiak National Wildlife Refuge Comprehensive Conservation Plan/EIS bears primary responsibility for preparing the plan.

Kodiak Refuge Planning Team

Barnes, Vic	Research Biologist
Bellinger, Jay	Kodiak Refuge Manager
Chatto, Tony	Fisheries Biologist
Frates, Jim	Wildlife Biologist
Jerome, Pete	Planning Team Leader
Menke, Dave	Outdoor Recreation Planner
Nation, Mary Lynn	Fish and Wildlife Biologist
Peterson, Larry	Fisheries Biologist
Rees, Michael	Assistant Planner
Ryan, Kevin	Assistant Refuge Manager
Vivian, Mike	Wildlife Biologist
Wassink, Connie	Public Involvement Specialist
Zwiefelhofer, Denny	Wildlife Biologist

Disciplinary Specialists and Support Staff

Bailey, Randy	Chief, Division of Fisheries Resources
Bigsby, Phil	Physical Scientist
DellaSilva, Sheri	Clerk/Typist
Diters, Chuck	Archaeologist
Gallagher, Patti	Graphics Specialist
Kirk, Bill	Botanist
Knauer, Bill	EIS Coordinator
Leedy, Bob	Subsistence Specialist
Maloney, Jean	Computer Systems Analyst
Seemel, Robert	Wilderness Specialist
Williams, Wally	Chief, Land Status & Mapping
Zupanic, Gary	Cartographer

APPENDIX B. Consultation and Coordination.

The public involvement program is described in the introduction. The following agencies, organizations or individuals have received copies of this draft comprehensive conservation plan for Kodiak Refuge, for review and comment.

MEMBERS OF CONGRESS

Senator Frank H. Murkowski
Senator Ted Stevens
Representative Don Young

FEDERAL AGENCIES

- Alaska Federal-State Land Use Council
- Department of Agriculture
    - U. S. Forest Service
    - Soil Conservation Service
- Department of Commerce
    - National Marine Fisheries Service
    - North Pacific Fishery Management Council
    - National Oceanic and Atmospheric Administration
- Department of Defense
    - U. S. Army Corps of Engineers
    - Defense Mapping Agency, Hydro/Topo
- Department of Energy
    - Federal Energy Regulatory Commission
- Department of Health and Human Services
    - U. S. Public Health Service
        - Alaska Native Medical Center
- Department of Housing and Urban Development
- Department of the Interior
    - Alaska Resources Library
    - Bureau of Indian Affairs
    - Bureau of Land Management
    - Bureau of Mines
    - Minerals Management Service
    - National Park Service
    - Office of Surface Mining
    - U. S. Geological Survey
- Department of Transportation
    - Federal Aviation Administration
    - Federal Highway Administration
    - U.S. Coast Guard
- General Services Administration
    - Federal Information Center
- Marine Mammal Commission
- The President's Advisory Council on Historic Preservation
- U. S. Environmental Protection Agency

STATE AGENCIES (through the State Conservation System Unit Planning Coordination Office)

Office of the Governor
    Office of Coastal Management
    Office of Management & Budget
Department of Commerce and Economic Development
    Alaska Power Authority
Department of Community and Regional Affairs
Department of Education
    Alaska State Library
Department of Environmental Conservation
Department of Fish and Game
    Board of Fisheries
    Board of Game
Department of Health and Social Services
Department of Labor
Department of Law
Department of Military Affairs
Department of Natural Resources
Department of Public Safety
    Division of Fish and Wildlife Protection
Department of Revenue
Department of Transportation and Public Facilities
Oil and Gas Conservation Commission
Alaska Historical Commission
University of Alaska
    Alaska Cooperative Fish Research Center
    Arctic Environmental Information and Data Center
    Elmer E. Rasmusen Library
    Institute of Arctic Biology
    Institute for Social and Economic Research
    Mineral Industries Research Laboratory
    School of Agricultural & Land Resources
    School of Economic and Public Affairs
    School of Fisheries & Science
    Cross-Cultural Education Department

LOCAL GOVERNMENTS, CIVIC ORGANIZATIONS, AND GENERAL CIRCULATION LIBRARIES

Akhiok, City of
Aleknagik, City of
Allakaket, City of
Aleutians East Coastal Resources Service Area, Board of
Anchorage, Municipality of
    Anchorage Public Library System
Bristol Bay Borough
Bristol Bay Coastal Resources Service Area, Board of
Chignik Bay School
Chignik Lagoon School
Chignik Lake School

Colorado State University
    Library
    Life Sciences Center
Cold Bay, City of
Dillingham, City of
    Dillingham Library
Dillingham City Schools
Eklutna, Inc.
Ekwok, City of
Fairbanks North Star Borough
Goodnews Bay, City of
Goodnews Bay School
Karluk, City of
King Cove, City of
Kodiak Arts Council
Kodiak, City of
    A. Holmes Johnson Memorial Library
Kodiak Historical Society
Kodiak Island Borough
Larsen Bay, City of
Manokotak, City of
Newhalen, City of
New Stuyahok, City of
Nondalton, City of
Old Harbor, City of
Ouzinkie, City of
Port Heiden, City of
Port Lion, City of
Quinhagak, City of
Sand Point, City of
Sand Point City School
Seattle Public Library
    Documents Library
Soldotna, City of
Togiak, City of
Unalaska, City of
Valdez Historial Society

NATIVE ORGANIZATIONS

Alaska Federation of Natives
Aleutian-Pribilof Island Association
Akiachak IRA Council
Belkofsky Native Village
Bristol Bay Native Association
Chignik Native Village
Chignik Lagoon Native Village
Chignik Lake Village Council
Clarks Point Village Council
Cook Inlet Native Association
Eduk Native Village
Evansville Village Council
Goodnews Native Village
Ivanof Bay Village Council

Karluk IRA Council
Kawerak, Inc.
    Eskimo Walrus Commission
Kokhanok Village Council
Koliganek Village Council
Kodiak Area Native Association
Larsen Bay Tribal Council
Levelock Village Council
Nelson Lagoon Native Village
Newhalen Native Council
Nondalton Village Council
Pedro Bay Village Council
Perryville Village Council
Pilot Point Traditional Council
Portage Creek Village Council
Quinhagak Traditional Council
South Naknek Village Council
Togiak Traditional Council
Tuluksak IRA Council
Twin Hills Village Council
Ugashik Village Council
Unalaska Village Council

MEDIA

ALASKA FISHERMAN'S JOURNAL
ALASKA NATIVE NEWS
ANCHORAGE DAILY NEWS
ANCHORAGE TIMES
Barometer (U.S. Coast Guard, Kodiak)
BRISTOL BAYTIMES
BOROUGH BUGLE
KADIAK TIMES
KODIAK DAILY MIRROR

Radio Stations
- Alaska Public Radio Network
- KBBI-AM, Homer
- KBYR-AM, KNIK-FM, Anchorage
- KKGR-FM, Anchorage
- KDLG-AM, Dillingham
- KENI-AM, Anchorage
- KFQD-AM, Anchorage
- KGOT-AM, Anchorage
- KGTL-AM & FM, Homer
- KHAR-AM, KHLV-FM, Anchorage
- KJNP-AM & FM, North Pole
- KKEN-AM, Kenai
- KMXT-FM, Kodiak
- KRKN-FM, Anchorage
- KRXA-AM, Seward
- KSKA-FM Public, Anchorage
- KSRM-AM, Soldotna

    KVOK-AM, Kodiak
    KWHL-FM, Anchorage
    KYAK-AM-KGOT-FM, Anchorage
KUAC-FM & Television, Fairbanks
Television Stations
    KAKM, Public Television, Anchorage
    KTUU-TV, Anchorage
    KIMO-TV, Anchorage
    KTVA-TV, Anchorage
    Cablevision, Kodiak
Reuters News

SPECIAL-INTEREST GROUPS AND PRIVATE BUSINESS

AAA Alaskan Outfitters
A & P Tours
Afognak Wilderness Lodge
Agresources
Air Transport Services
Alaska Alpine Club
Alaska Association of Soil Conservation Subdistricts
Alaska Boating Association
Alaska Center for the Environment
Alaska Conservation Society
Alaska Draggers Association
Alaska Fishing Safari
Alaska Land Management Associates
Alaska Legal Services Corp.
Alaska Loggers Association
Alaska Map Service
Alaska Miners Association, Inc.
Alaska Oil and Gas Association
Alaska Outdoor Council
Alaska Pacific University
Alaska Peninsula Corporation
Alaska Professional Hunters Association
Alaska Professional Sportfishing Association
Alaska River Safari
Alaska Sportsmen's Council
Alaska State Chamber of Commerce
    Anchorage Chamber of Commerce
    Kodiak Area Chamber of Commerce
Alaska Wilderness Council
Alaska Wildlife Council
Aleut Corp.
American Cetacean Society
American Fisheries Society
American Petrofina Co. of Texas
American Shore & Beach Preservation Association
American Wilderness Alliance
AMOCO Production Company
Anderson Marine Charters
Andy's Alaska Fishing Safari

Arvig, Inc.
Atlantic Richfield Company
Atwater Consultants, Ltd.
B & B Fishing Adventures
B & B Herring Marketing Association
Becharof Corp.
Bering Sea Fishermen's Association
Bering Straits Regional Corp.
Black & Associates
Bristol Bay Native Corp.
Calista Corp.
Canned Salmon Institute
Christopher Resources, Inc.
Center for Environmental Education
Center for Northern Studies
Center of Urban Affairs, Northwestern University
Charter Service (Port Lions)
Chevron U.S.A., Inc.
Chignik Boat Owners Association
Choggiung Ltd.
Cities Service Oil Company
Citizens Advisory Commission on Federal Areas
Clair's Cliffside Lodge
Clinton Oil Company
Club Pacific
Cockrell Corporation
Columbia Wards Cannery
COMINCO Alaska
Commercial Fishermen of Cook Inlet
Commercial Fishermen's Cooperative Association
Coopers & Lybrand
Cook Inlet Region, Inc.
Copper River Native Association
Commonwealth North
CONOCO, Inc.
Consolidated Natural Gas Service
Continental Shelf Associates
Cultural Dynamics
Cy's Sporting Goods
Dalco Oil Co.
Dalton Dalton Newport
Dame Juliana Berner's Fly Association
Danzhit-Hantaii Corp.
D'Appolonia Consulting Engineering, Inc.
Darbyshire, Inc.
Dave Duncan & Sons, Ltd.
Depco, Inc.
Diamond Shamrock Corp.
Dodge Outfitters
Dream Boat Annie
Dresser Atlas
Eklutna, Inc.
Environmental Defense Fund, Inc.
Ethyl Development Corp.

Exxon Company USA, Inc.
F. Eberstadt & Company, Inc.
Falls Creek Environmental
False Pass Corp.
Far West, Inc.
Fisherman's Council
Fishing Unlimited
Flirite
Freeport Minerals Company
Friends of Animals, Inc.
Friends of the Earth
G & S Sporting Goods
General American Oil Co. of Texas
Getty Oil Company
Goodnews Bay Fisheries Coop.
Great Water Associates
Green Construction Company
Greenpeace U.S.A.
Guardian Oil Company
Gulf of Alaska Cleanup Organization
Hooks, McCloskey & Associates, Inc.
Hugh Glass Backpacking Co.
Hughes, Thorsness, Gantz, Powell & Brindin
Hunt Oil Company
HWW Consultants
Igiugig Native Corp.
Iliama Natives, Ltd.
Imarpik Aquaculture Association
International Association for Fish & Wildlife
International Brotherhood of Electrical Workers
Interior River Users Group
Island Air Service
Island Charter Service
Island Terrific Tours
Karluk Lodge
Kenai Community Library
Kenai Guide Service
King Salmon Lodge
Kodiak Air Taxi
Kodiak Buskin River Inn
Kodiak Electric Assn., Inc.
Kodiak Island Hospital
Kodiak Island Set Netters Association.
Kodiak Sea Charters
Koliganek Natives, Ltd.
Koniag, Inc.
Kuitsarak, Inc.
Lambert Guide Service
Lane County Audubon Society
Lee Houston Associates
Levelock Natives, Ltd.
Lyndon Air Freight
Marathon Oil Company
Mack's Sport Shop

Manokotak Natives Ltd.
Markstein Beverage Co.
McKinley Mountainmen Muzzleloading Rifle Club
Mid-Continental Oil & Gas Association
Miners Advocacy Council
Mittsubishi International Corporation
Mobil Oil Corporation
Morrison-Knudsen Company, Inc.
Munsey Brown Bear Camp
NANA Development Corp.
National Audubon Society Chapters
  Anchorage
  Kenai Peninsula
  Kodiak
  Lane County
  Portland
  Seattle
  Tahoma
  Yellowstone Valley
National Bank of Alaska
National Coalition Marine Cons., Inc.
National Inholders Association
National Parks & Conservation Association
National Refuge Association
National Rifle Association
National Wildlife Federation
Natural Gas Corp. of California
Natural Resources Defense Council
Nature Conservancy
Niagra Share Corporation
Nondalton Native Corp.
Nordic Ski Club
North Pacific Fisheries Association
Northern Alaska Environmental Center
Nunam Kitlutsisti
Ocean Drilling & Exploration Co.
Oceanographic Consultants
Oceanside Corp.
Oregon Natural Resources Council
Oxy Petroleum, Inc.
P & T Outfitters
Pacific Alaska LNG Association
Pacific Atlantic Oil Company
Pacific Marine Fisheries Commission
Paug-Vik, Inc.
Petroleum Information Corporation
Petty-Ray Geophysical, Inc.
Phillips Petroleum
Prominent Mound Fisheries
Qanirtuug, Inc.
Rainbow King Lodge

Reading & Bates Petroleum Co.
The Real Alaska Coalition
Red Quill Lodge
Reeve Aleutian Airways, Inc.
Rohrer's Bear Camp
Rose Assoc., Inc.
Saguyak, Ltd.
Sanak Corp.
SEAIR
Shaheen Natural Resources Co.
Simmerman Photographs
Sheffield House (Kodiak)
Shelikof Lodge
Shell Oil Co.
Shumagin Corp.
Sportsmens' Game Preservation
T & B Marine & Equipment Leasing
Tenneco Oil Co.
Terra Resources, Inc.
Tetra Tech, Inc.
Texaco, Inc.
Texas Eastern Exploration Corp.
The Institute of Ecology
The Sierra Club
    National Conservation Department
    Legal Defense Fund
    Alaska Field Office
    Arguello Group
    Cascade Chapter
    Oregon Chapter
    Redwood Chapter
The Wilderness Society
    Alaska Programs
    Wildlife Refuge Program
The Wildlife Society
Transamerica Oil Company
TRANSCO Exploration Company
Trout Unlimited
    Alaska
    East Jersey
Trustees for Alaska
Tulkisarmute Corp.
Uganik Trading Co.
Uyak Air Service
Uyak Bay Fisheries
United Fishermen of Alaska
United Fishermen's Marketing Association
Western Alaska Coorp. Market Assoc.
White Shield Exploration Corporation
Viking Air Service
Wildlife Management Institute
Woodward-Clyde Consultants
Wrangell Trollers Association

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APPENDIX D. Scientific names of the animals of Kodiak Refuge and surrounding area (after Taylor, 1979).

FISH

Entosphenus tridentatus	Pacific lamprey
Salmo gairdneri	Rainbow trout
Salmo gairdneri	Steelhead trout
Salvelinus alpinus	Arctic char
Salvelinus malma	Dolly Varden
Oncorhynchus gorbuscha	Pink salmon
Oncorhynchus nerka	Sockeye salmon
Oncorhynchus tshawytscha	Chinook salmon
Oncorhynchus kisutch	Coho salmon
Oncorhynchus keta	Chum salmon
Gasterosteus aculeatus	Threespine stickleback
Pungitius pungitius	Ninespine stickleback
Cottus aleuticus	Coastrange sculpin

BIRDS[a]

Gavia stellata	Red-throated loon
Gavia arctica	Arctic loon
Gavia immer	Common loon
Gavia adamsii	Yellow-billed loon
Podiceps auritus	Horned grebe
Podiceps grisegena	Red-necked grebe
Diomeda nigripes	Black-footed albatross
Diomeda immutabilis	Laysan albatross
Fulmarcus glacialis	Northern fulmar
Pterodroma inexpectata	Mottled petrel
Puffinus griseus	Sooty shearwater
Puffinus tenuirostris	Short-tailed shearwater
Oceanodroma furcata	Fork-tailed storm-petrel
Oceanodroma leucorhoa	Leach's storm-petrel
Phalacrocorax auritus	Double-crested cormorant
Phalacrocorax pelagicus	Pelagic cormorant
Phalacrocorax urile	Red-faced cormorant
Ardea herodias	Great blue heron
Cygnus columbianus	Tundra (whistling) swan
Anser albifrons	Greater white-fronted goose
Chen canagica	Emperor goose
Branta bernicla	Brant
Branta canadensis	Canada goose
Anas crecca	Green-winged teal
Anas platyrhynchos	Mallard
Anas acuta	Northern pintail

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[a] All birds listed as casual or accidental on the Kodiak Island bird list have been omitted from this list.

Anas discors	Blue-winged teal
Anas clypeata	Northern shoveler
Anas strepera	Gadwall
Anas penelope	Eurasian wigeon
Anas americana	American wigeon
Aythya collaris	Ring-necked duck
Aythya affinis	Lesser scaup
Aytha marila	Greater scaup
Somateria mollissima	Common eider
Somateria spectabilis	King eider
Polysticta stelleri	Steller's eider
Histrionicus histrionicus	Harlequin duck
Clangula hyemalis	Oldsquaw
Bucephala clangula	Common goldeneye
Bucephala islandica	Barrow's goldeneye
Bucephala albeola	Bufflehead
Melanitta nigra	Black scoter
Melanitta perspicillata	Surf scoter
Melanitta fusca	White-winged scoter
Mergus merganser	Common merganser
Lophodytes cucullatus	Hooded merganser
Mergus serrator	Red-breasted merganser
Haliaeetus leucocephalus	Bald eagle
Circus cyaneus	Northern harrier (marsh hawk)
Accipiter striatus	Sharp-shinned hawk
Accipiter gentilis	Northern goshawk
Buteo lagopus	Rough-legged hawk
Aquila chrysaetos	Golden eagle
Falco columbarius	Merlin
Falco peregrinus	Peregrine falcon
Falco rusticolus	Gyrfalcon
Lagopus lagopus	Willow ptarmigan
Lagopus mutus	Rock ptarmigan
Pluvialis squatarola	Black-bellied plover
Pluvialis dominica	Lesser (American) golden plover
Charadrius semipalmatus	Semipalmated plover
Haematopus bachmani	American black oystercatcher
Tringa flavipes	Lesser yellowlegs
Tringa melanoleuca	Greater yellowlegs
Tringa solitaria	Solitary sandpiper
Heteroscelus incanus	Wandering tattler
Actitis macularia	Spotted sandpiper
Numenius phaeopus	Whimbrel
Limosa lapponica	Bar-tailed godwit
Limosa fedoa	Marbled godwit
Arenaria interpres	Ruddy turnstone
Arenaria melanocephala	Black turnstone
Aphriza virgata	Surfbird

Calidris alba	Sanderling
Calidris pusilla	Semipalmated sandpiper
Calidris mauri	Western sandpiper
Calidris minutilla	Least sandpiper
Calidris bairdii	Baird's sandpiper
Calidris melanotos	Pectoral sandpiper
Calidris acuminata	Sharp-tailed sandpiper
Calidris ptilocnemis	Rock sandpiper
Calidris alpina	Dunlin
Limnodromus griseus	Short-billed dowitcher
Limnodromus scolopaceus	Long-billed dowitcher
Gallinago gallinago	Common snipe
Phalaropus lobatus	Red-necked (northern) phalarope
Phalaropus fulicaria	Red phalarope
Stercorarius pomarinus	Pomarine jaeger
Stercorarius parasiticus	Parasitic jaeger
Stercorarius longicaudus	Long-tailed jaeger
Larus philadelphia	Bonaparte's gull
Larus canus	Mew gull
Larus argentatus	Herring gull
Larus thayeri	Thayer's gull
Larus glaucescens	Glaucous-winged gull
Larus hyperboreus	Glaucous gull
Rissa tridactyla	Black-legged kittiwake
Xema sabini	Sabine's gull
Sterna paradisaea	Arctic tern
Sterna aleutica	Aleutian tern
Uria aalge	Common murre
Uria lomvia	Thick-billed murre
Cepphus columba	Pigeon guillemot
Brachyramphus marmoratus	Marbled murrelet
Brachyramphus brevirostris	Kittlitz's murrelet
Synthliboramphus antiquus	Ancient murrelet
Ptychoramphus aleuticus	Cassin's auklet
Cyclorrhynchus psittacula	Parakeet auklet
Aethia cristatella	Crested auklet
Cerorhinca monocerata	Rhinoceros auklet
Fratercula cirrhata	Tufted puffin
Fratercula corniculata	Horned puffin
Nyctea scandiaca	Snowy owl
Surnia ulula	Northern hawk-owl
Asio flammeus	Short-eared owl
Argolius funereus	Boreal owl
Ceryle alcyon	Belted kingfisher
Picoides pubescens	Downy woodpecker
Picoides tridactylus	Three-toed woodpecker
Tachycineta bicolor	Tree swallow
Tachycineta thalassina	Violet-green swallow
Riparia riparia	Bank swallow
Petrochelidon pyrrhonota	Cliff swallow
Hirundo rustica	Barn swallow
Pica pica	Black-billed magpie

Corvus caurinus	Northwestern crow
Corvus corax	Common raven
Parus atricapillus	Black-capped chickadee
Sitta canadensis	Red-breasted nuthatch
Certhia familiaris	Brown creeper
Troglodytes troglodytes	Winter wren
Cinclus mexicanus	American dipper
Regulus satrapa	Golden-crowned kinglet
Regulus calendula	Ruby-crowned kinglet
Catharus minimus	Gray-cheeked thrush
Catharus guttatus	Hermit thrush
Turdus migratorius	American robin
Ixoreus naevius	Varied thrush
Anthus spinoletta	Water pipit
Bombycilla garrulus	Bohemian waxwing
Lanius excubitor	Northern shrike
Vermivora celata	Orange-crowned warbler
Dendroica petechia	Yellow warbler
Dendroica coronata	Yellow-rumped warbler
Wilsonia pusilla	Wilson's warbler
Spizella arborea	American tree sparrow
Passerculus sandwinchensis	Savannah sparrow
Passerella iliaca	Fox sparrow
Melospiza melodia	Song sparrow
Melospiza lincolnii	Lincoln's sparrow
Zonotrichia atricapilla	Golden-crowned sparrow
Zonotrichia leucophrys	White-crowned sparrow
Junco hyemalis	Dark-eyed junco
Calcarius lapponicus	Lapland longspur
Plectrophenax nivalis	Snow bunting
Euphagus carolinus	Rusty blackbird
Leucostricte arctoa	Rosy finch
Pinicola enucleator	Pine grosbeak
Loxia curvirostra	Red crossbill
Loxia leucoptera	White-winged crossbill
Carduelis flammea	Common redpoll
Carduelis pinus	Pine siskin

MAMMALS

Myotis lucifugus	Little brown myotis
Lepus americanus	Snowshoe hare
Tamisciurus hudsonicus	Red squirrel (Afognak only)
Castor canadensis	Beaver
Microtus oeconomus	Tundra vole
Vulpes vulpes	Red fox
Ursus arctos	Brown bear
Mustela erminea	Short-tailed weasel
Lutra canadensis	River otter
Martes americana	Marten (Afognak only)
Odocoileus hemonius sitkensis	Sitka blacktail deer

Oreamnos americanus	Mountain goat
*Cervus elaphus roosevelti*i	Roosevelt elk
Rangifer tarandus	Reindeer
Enhydra lutris	Sea otter
Callorhinus ursinus	Northern fur seal
Eumetopias jubatus	Steller's (northern) sea lion
Phoca vitulina	Harbor seal
Megaptera novaeanyliae	Humpback whale
Balaenoptera physalus	Fin whale
Balaenoptera borealis	Sei whale
Balaenoptera acutorostrata	Minke whale
Eschrichtius robustus	Gray whale
Berardius bairdi	Baird's beaked whale
Orcinus orca	Killer whale
Globicephala sieboldi	Pacific pilot whale
Phocenoides dalli	Dall's porpoise
Phocoena phocoena	Harbor porpoise

APPENDIX E. Definitions of habitat ratings.

A rating system was developed by Fish & Wildlife Service biologists to aid in evaluating the habitats used by the refuge's wildlife species or groups of species. The ratings (i.e., key, important, other general use, unknown or not present) were based on comparisons of several refuge-specific variables, such as importance of the areas for the species' life cycle and population densities within the refuge. (Specific criteria used in rating the species and groups of species are on file at the U.S. Fish and Wildlife Service Regional Office in Anchorage.) Species distribution maps, based on field observations, surveys, and habitat models, were used in making these comparisons. The ratings in turn were used in assessing the relative effects of the refuge management alternatives. The paragraphs below define the five ratings.

Key Habitats

Key habitats were defined as discrete geographical areas that rank high in supporting essential life requirements of the wildlife species on the refuge. Examples of key habitats include one or more of the following: (1) pupping, calving, colonial nesting, spawning, rearing, vital feeding and haulout areas; (2) highly productive breeding and nesting areas; (3) sites satisfying unique population requirements (i.e., stopover and high concentration sites); (4) habitats regularly associated with endangered species; (5) unique ecological systems (e.g., eelgrass beds); and (6) areas supporting a large proportion of one species or species group during five key time periods (i.e., nesting, molting, spring stopover, fall stopover, and winter).

Important Habitats

Important habitats are characterized as areas with one or more of the following: (1) moderate or intermittently high concentrations of wildlife species; (2) productive fish or wildlife populations; (3) elements necessary for special uses including migration corridors and feeding areas; (4) the presence or potential presence of endangered species; (5) a greater than average number of species present during three or more key seasons; or (6) elements essential for the maintenance of key habitats.

Other General Use Habitats

Other habitats are those necessary to support the existing distribution, abundance and productivity of refuge wildlife populations. General use habitats are often characterized by large expanses of land that are used by a species, but not in moderate or high densities (based on present-day knowledge). Several large areas classified as "other" may be elevated to key or important as more information is collected.